Huntleigh
DIAGNOSTICS

BABY DOPPLEX 4000®, BABY DOPPLEX 4002®

CUSTOMER SUPPORT DOCUMENTATION

SERVICE MANUAL

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1 General Information

1.1 Introduction

This service manual provides the technical information required for repair and maintenance of the Huntleigh Diagnostics ***Baby Dopplex 4000*** and ***Baby Dopplex 4002***.

1.2 Servicing Policy

Due to the nature of static-sensitive surface-mount technology, specialised equipment and training is required when working on the surface mounted components used within this product.

For this reason circuit diagrams are not included in this manual. Block diagrams and fault finding sections are included to make fault finding to leaded component level possible.

Units within the warranty period must not be dismantled and should be returned to Huntleigh Diagnostics for repair. Any units returned showing signs of tampering or accidental damage will not be covered under the warranty (refer to user manual for further details).

1.3 Product Description

General

The ***Baby Dopplex 4000*** and ***Baby Dopplex 4002*** comprise a main unit (which can be either free-standing, trolley or wall-mounted), two transducers (US* and Toco). A patient event marker and a FECG legplate (optional). *BD4002 is supplied with 2 US transducers.

Main Unit

This houses the printer and electronic circuitry - digital and analogue signal processing, audio, display and power supply systems.

Signals from the transducers are processed and displayed on the large LED displays. The ultrasound signal is also amplified, and output via the integral loudspeaker. A volume control provides adjustment of sound level as required. Processing for the FECG signal is also included.

A liquid crystal display (LCD) displays the system menu and other information. Various parameters can be selected and/or changed as necessary using the adjacent controls.

Also mounted on the control panel are controls for volume up/down, print start/stop, Toco zero and clinical event marker.

Transducers

The transducer connectors are colour coded to indicate function: the US/FECG connector is red, the Toco connector is blue.
The transducers are held in place by elasticated straps.

Patient Event Marker

This is a hand-held push-button which is pressed by the patient when she feels fetal or uterine activity.

☞ ***The patient and clinical event markers are distinguished from each other on the paper, patient at the bottom of the FHR grid and clinical at the top.***

1.4 Antistatic Handling, Electro Static Discharge (ESD)

The ***Baby Dopplex*** uses Electrostatic Discharge Sensitive Devices (ESD's) in its manufacture. The damage they suffer when handled incorrectly may be catastrophi***c.***

More often and potentially even worse, the damage may be partial or latent, seriously impairing the reliability of the unit.

Due to the nature of the components used within the ***Baby Dopplex***, special precautions must be taken to avoid damage to the circuitry. Static damage may not be immediately evident but could cause premature failure.

The ***Baby Dopplex*** must only be dismantled and serviced within an ESD protected area (EPA) as defined by CECC00015 (published by CENELEC) to avoid damage to the assemblies.

1.5 Construction

The main unit comprises five PCB's, the main PCB, display PCB, PSU, end of paper PCB and rear panel connector PCB. All boards with the exception of the PSU are populated with surface mounted components.

The toco transducer consists of a termination PCB and a strain gauge.
The ultrasound transducer contains a single PCB, a multi element piezo crystal array and a circular termination PCB.
The FECG transducer contains a single PCB and isolation amplifier with two scalp electrode connections and a legplate disk for a maternal connection.

All electromechanical and through hole components are serviceable using standard tools and soldering techniques, provided that anti-static precautions are always taken. Recommended servicing is limited to replacement of assemblies detailed in this manual.

2 Safety Aspects

2.1 Safety

- The ***Baby Dopplex*** and its transducers are designed to high standards of performance, reliability and safety.
- Functional and safety checks should always be made after carrying out any repairs or dismantling the equipment.

It is recommended that regular inspections are to be made to check the integrity of the unit, and to ensure cables are not showing any signs of wear or noise when flexed.

2.2 Safety Testing

Using suitable safety test equipment, refer to the following guidelines.

Earth Bonding Test points

a) Test the exposed chassis, accessible through the moulding apertures on the underside of the unit.

b) Test the metal shroud of the toco socket.

c) Test the shells of the rear panel D-type connectors.

The maximum allowable reading at all points is 0.1 .

Earth Leakage Test

Set the on/off switch on the rear of the unit to the on position.
The maximum allowable leakage current is 100 A.

Breakdown Test

Set the on/off switch on the rear of the unit to the “on” position.

Apply 1500Vac to the mains connector, connecting the low voltage probe to the “EARTH” terminal. Firstly test the “LIVE” terminal and then the “NEUTRAL” for 60 seconds each. The maximum allowable reading is 1mA.

2.3 FECG Testing

Apply 1500Vac between the;

a) chassis earth and leg electrode plate

b) instrument live terminal and FECG terminals

c) instrument neutral terminal and FECG terminals

The maximum allowable reading being 10 A over 60 secs.

Caution

Do not apply test voltages to main unit FECG input socket directly

If you require any assistance with safety testing your Huntleigh Diagnostics equipment, contact Huntleigh Diagnostics. For the U.K. refer to the Health Equipment Information Document No 95 – Code Of Practice For Acceptance Testing Of Medical Equipment.

The following safety summary should be read before operating or carrying out any of the procedures described in this manual:

Cautions

- Do not use the ***Baby Dopplex*** in the presence of flammable gases such as anaesthetic agents.
- This product is **not** designed for sterile use. Do not use in the sterile field unless additional barrier precautions are taken.

Do not
- immerse main unit in any liquid. See section 2.4.
- use solvent cleaners.
- use high temperature sterilising processes (such as autoclaving).
- use E-beam or gamma radiation sterilisation.

2.4 Cleaning

Caution

Switch the unit off and disconnect from the mains before cleaning

Main Unit — If required, this can be wiped with a soft cloth dampened with a mild detergent, avoiding the connectors. Do not allow any fluid to seep into the connectors. Do not allow any fluid to seep into the unit.
Ensure the unit is completely dry before reconnecting to the mains.

Ultrasound Transducer and FECG Leg Plate — These should be cleaned by immersing in warm (50°C max.), mild detergent solution, using a bottle brush if necessary. Do not soak,or run under a tap. Rinse with clean water and dry thoroughly before use.

☞ ***Do NOT immerse connectors***

Caution

Phenolic or detergent based disinfectants containing cationic surfactants, ammonia based compounds, or antiseptic solutions such as Stericol or Hibiscrub should never be used on any part of the system as permanent damage will result.

Contractions Transducer (toco) — Wipe with a soft cloth dampened with a mild detergent solution, avoiding the connector. Do not allow any fluid to seep into the transducer. Dry thoroughly before use.

Belts — These may be hand-washed at 40°C max., using a mild detergent solution. Rinse with clean water and dry thoroughly (without using heat) before use.

Disinfection — **Transducers and Leg Plate Only.**

To assist with disinfection, wipe the transducers and leg plate with a soft cloth dampened with sodium hypochlorite 1000ppm, and wipe dry.
Please be sure to check your local infection control policies or equipment cleaning procedures.

2.5 Preventative Maintenance

The Huntleigh Diagnostics ***Baby Dopplex 4000*** and ***Baby Dopplex 4002*** are designed for a minimum amount of maintenance. To support the high standard of performance and safety, the safety and functional checks should be carried out as part of a regular maintenance routine.

Refer to the user manual for details of connection of cables and accessories, and also for the correct setting of controls which may have been altered during maintenance.

No attempt should be made to service the unit unless adequate workshop facilities and suitable staff are available.

2.6 CE marking

All rework procedures detailed in this service manual must be strictly adhered to, to ensure continuing compliance with EC Directive 93/42/EEC.

Any rework routine carried out outside the scope of this manual may result in the equipment no longer meeting this specification and the rework organisation will be responsible for this non-conformance.

3 Functional Testing

3.1 BD4000, BD4002 Main Unit

Switch the unit on by pressing the on/off switch at the back of the unit to the "on" position(**I**).

The ***Baby Dopplex*** displays will illuminate and you will hear a click from the loudspeaker. The message "Huntleigh Diagnostics" appears for an instant while the unit carries out a self-test.

Inspect the transducer cables and plugs for signs of damage and physical condition of the transducers.

The ultrasound transducer face should be free from marks and the toco boot undamaged. Remove any gel from the transducers if present.

Open printer tray, unit should display "Paper tray open" and remove paper pack.
Close paper tray, unit should display "End of paper". Refit paper pack ensuring that the shiny side is uppermost. This sensitive side can be easily marked with a fingernail.

Plug in the ultrasound, toco and event marker transducers, set the printer to 3cm/minute (menu option) and start the unit printing.

Press the patient event marker switch and observe the arrow at the bottom of the printout.
Press the clinical event marker on the display panel and an arrow should appear at the top of the printout.

Increase the volume using the up/down controls on the front panel and flex cable on the ultrasound transducer at the transducer and plug ends checking that no crackling is heard.

Replace the ultrasound transducer with the FECG leg plate. The unit should fast feed for a few seconds if the printer is still running when the ultrasound transducer is removed, and then continue printing.
Ensure that the FECG text appears at the bottom of the FHR scale on the trace.

3.2 Ultrasound Transducers

Reconnect the ultrasound transducer and input a signal by placing it in the palm of the hand and stroke the back of the hand approximately twice per second.

The display should indicate a rate of around 120 BPM after a few seconds. Continue this for one minute and check for a corresponding line on the fetal heart rate trace.

☞ ***Too strong a signal from an adult heart can overload the unit and result in false counting.***

The signal quality will vary during this test and can be observed in the top right hand corner of the LCD display. The four bands are illuminated for a good signal and progressively extinguish as the signal deteriorates. Repeat for FHR1 and FHR2 inputs using front panel to select audio channel (BD4002 only).

3.3 Toco

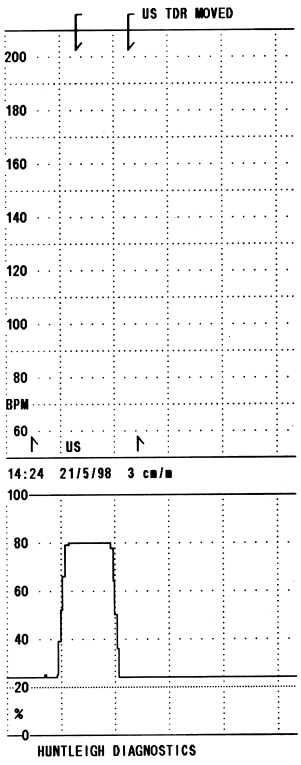
Place the toco transducer on a solid surface with the rubber boot uppermost and level.

Press the zero button on the front panel. Holding the toco transducer steady, flex the cable at the transducer and plug ends. Check the UA loading display and printout to ensure that there is no deviation from the zero line.

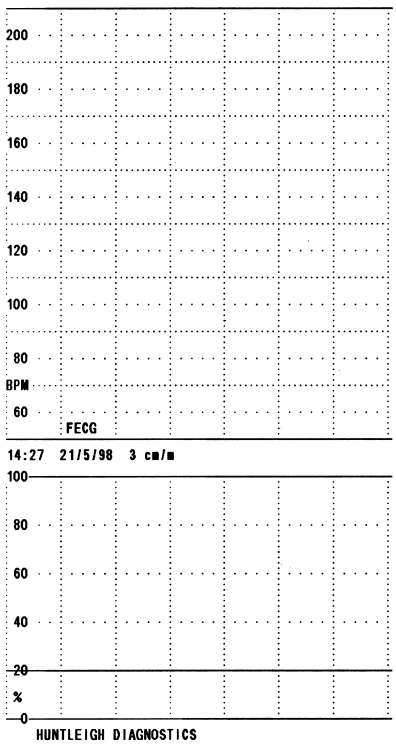
Depress the toco rubber boot gently and release, repeat this several times. Check that the UA display registers the change and returns to zero after a short delay.

With the rubber boot still uppermost and level, reset the zero then place a 100g weight in the centre of the boot.

The shape of this weight is important and the contact area on the rubber boot should be 12mm diameter maximum. The UA display should indicate 80% +/-5%.



Ultrasound Mode



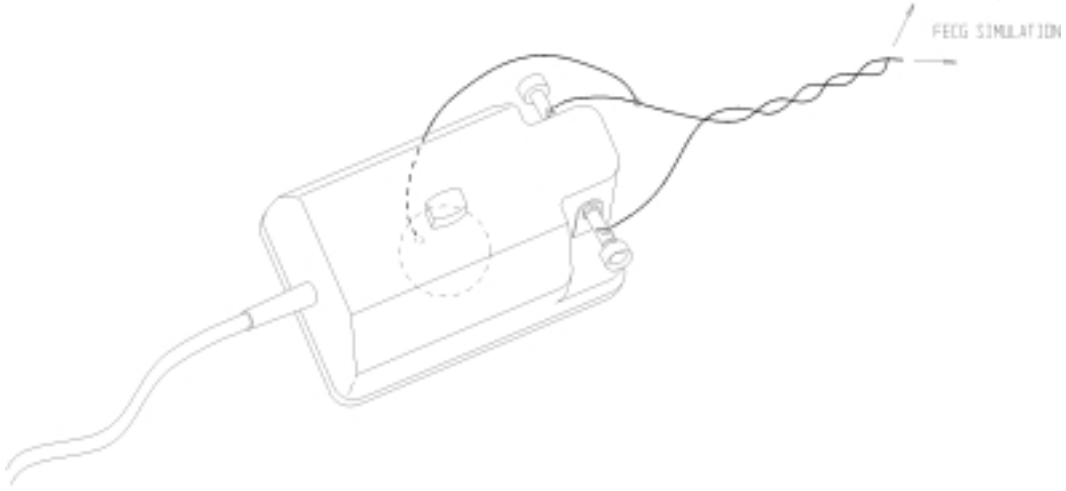
FECG Mode

Remove the weight after 30 seconds check for return to zero and turn the printer off, the printer should fast feed a blank section.

Compare the printout with the examples shown above, checking for print quality, date/time stamp, event markers, ultrasound, toco trace and mode (i.e. US/FECG).

3.4 FECG Functional Testing

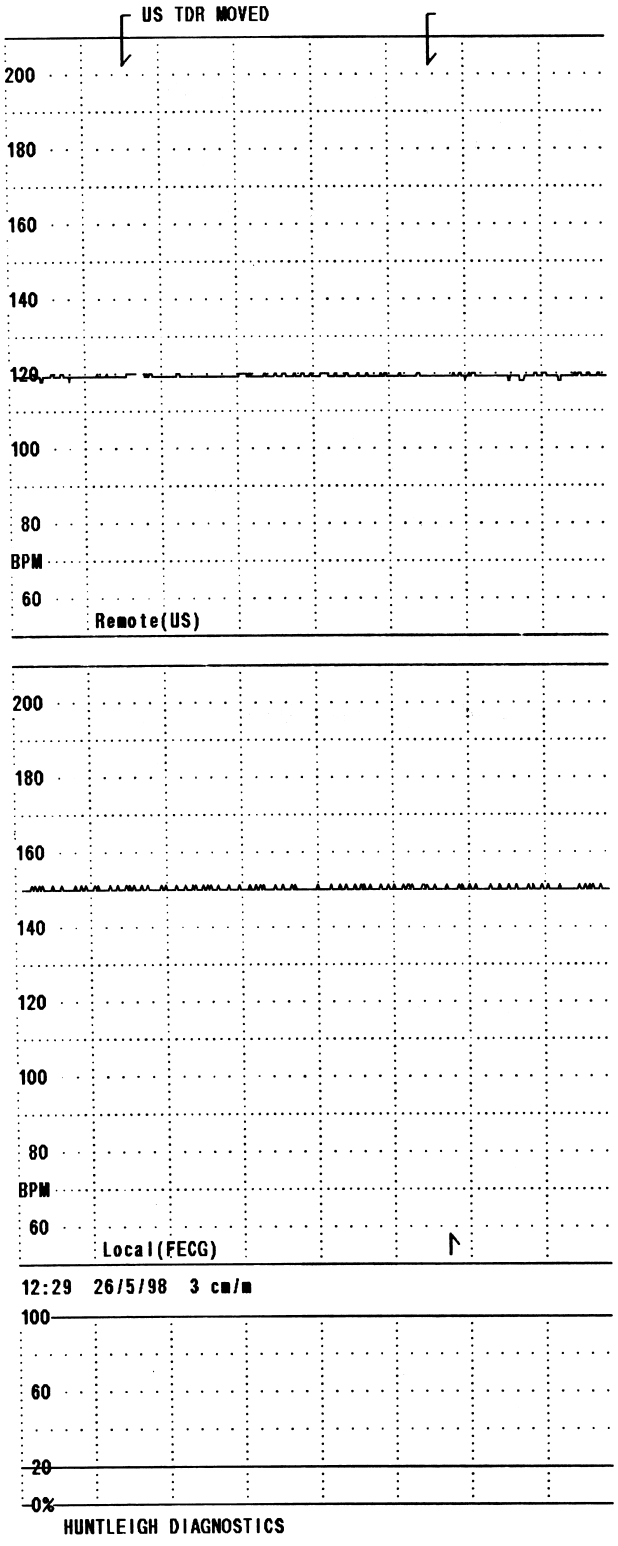
Reconnect the FECG legplate. Connect the patient terminals to an Fetal ECG simulator setting the voltage to between 25 V and 2mV. Only one FECG transducer can be used at any one time. Use of an adult ECG simulator may cause erroneous readings.
The ECG rate should be set between 30-240 and checked across its range.



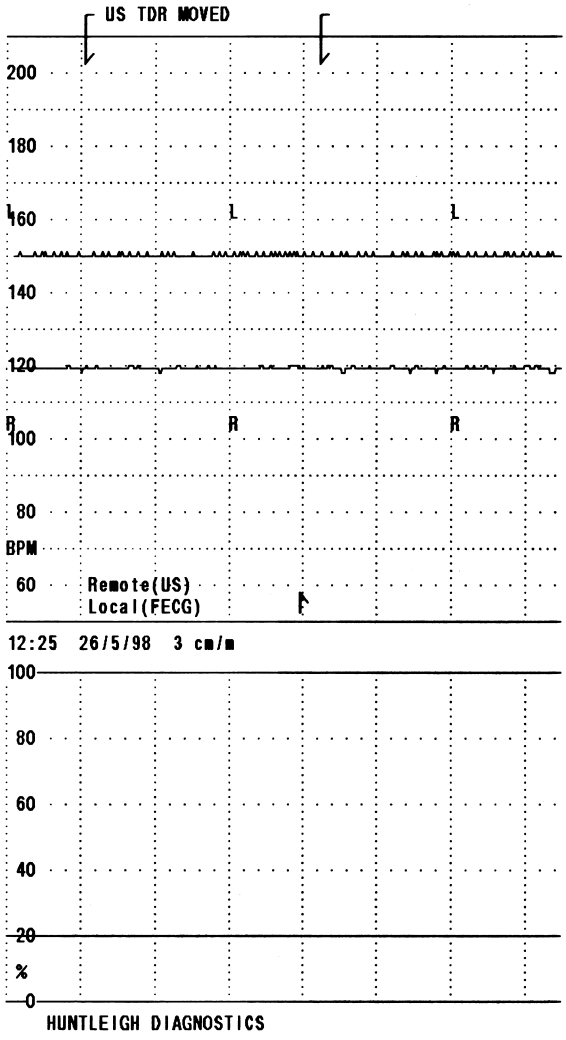
3.5 Twins Functional Testing - BD4000

Connect two BD4000 units together using the connection lead supplied with the twins kit. The monitor with the cable end marked '1' causes the unit to be the LOCAL unit while the other unit defaults to REMOTE.
The display on the LOCAL BD4000 should display “Remote FHR =” in the top line of the text display.
Connect an ultrasound transducer to both units and input a signal on the REMOTE unit by stroking the ultrasound transducer.
The REMOTE unit LCD should display 'Twins Remote Unit' and the printer should be inoperative.
The FHR should be displayed on both the REMOTE LED and LOCAL LCD displays.

Set the printer on the LOCAL unit to print and with a signal to the REMOTE unit, a corresponding trace should be printed.
When full width paper(210mm) is loaded, the LOCAL unit will print two FHR grids one above the other and one toco trace.
With the normal paper(150mm) fitted, the two FHR traces are overlaid on one grid, and identified periodically by the letters 'R' and 'L'.



210mm paper(wide)



150mm paper(normal)

3.6 Twins Functional Testing - BD4002

Fit both US transducers and toco transducer and test as detailed in section 3.2.

Only one FECG transducer can be used at any one time and should be tested as detailed in section 3.4.

When full width paper(210mm) is loaded, the unit will print two FHR grids one above the other and one toco trace.
With the normal paper(150mm) fitted, the two FHR traces are overlaid on one grid, and identified periodically.

4 Specification

General

Product Name:	Baby Dopplex 4000/Baby Dopplex 4002
Model No:	BD4000/BD4002

Physical

Size - control unit:	93mm x 380mm x 250mm (HxWxD)
Weight:	4.5Kg

Environmental

Operating Temperature:	+10^{o}C to +30^{o}C
Storage Temperature:	-10^{o}C to +40^{o}C

Electrical

Power Supply:	100-250V a.c. 50/60Hz
Fuse Type:	T2A 250V
Audio Power:	1 Watt max

Ultrasound Transducer

Transmitter frequency:	US1 - 1.5MHz +/-1%
Acoustic Output:	Under the requirements laid down in IEC1157: 1992, the peak negative acoustic pressure does not exceed 1MPa. the output beam intensity does not exceed 20mW/cm^2 and the spatial-peak temporal-average intensity does not exceed 100mW/cm^2.

Contractions Transducer

Range:	0 to 100% relative units.
Max. Load:	300g.

Regulatory Compliance/Standards

Complies with:	BS5724 : Part 1 : 1989 IEC601-1 : 1988 EN60601-1 : 1990

EN60601-1 Classification:	Type of shock protection - Class I
	Degree of shock protection - Type B
	Leg Plate & IUP Module Type BF
Protection Against Water Ingress	Ordinary equipment
Degree of Safety in Presence of Flammable Gases:	Not suitable for use in the presence of flammable gases.
Mode of Operation:	Continuous

Performance

FHR Range:	US 50 to 210 BPM FECG 30 to 240 BPM
FHR Accuracy:	+/- 1BPM over full range.
FHR Scale Options:	50 to 210 BPM at 20 BPM/cm, 30 to 240 BPM at 30 BPM/cm.

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Medical Devices Directive 93/42/EEC

5 Technical Description

5.1 The Doppler Principle

The ***Baby Dopplex*** uses the Doppler principle for non-invasively monitoring movement within the body.

The Doppler principle states that if a signal is transmitted at a fixed frequency and is reflected by a moving body, the frequency of the received signal will be shifted. An increase in frequency results if the reflector is moving towards the transmitter/receiver, and a decrease results if moving away from the transmitter/receiver. The amount of frequency shift is proportional to the velocity of the reflector relative to the transmitter/receiver.

In the Dopplex range, a fixed frequency ultrasonic signal is transmitted from the transducer into the body. This is reflected from, for example, the fetal heart. The signal is reflected from the heart and is received by the transducer. Due to the movement of the fetal heart, a frequency shift results, which is proportional to the fetal heart velocity.

5.2 Doppler Audio Processing

The ***Baby Dopplex*** ultrasound transducer contains a transmitter and receiver. In use, the transducer sends out a pulsed ultrasonic signal, generated by the piezo-ceramic transmitter crystals, at 1.5 MHz.

This signal is scattered by blood cells or any other “interface” such as skin, muscle layers, organs, walls of vessels etc. A small proportion of the scattered signal will be reflected back and detected by the receiver.

By demodulating the received signal (removing the high frequency carrier) the Doppler shifted component (i.e. the difference between the transmitted and received signals) can be produced.

With typical target velocities found in the human body, this Doppler shift signal falls within the audio frequency range. It can therefore simply be amplified and heard through a loudspeaker.

It is important to remember that the sound you hear is an artificial sound, the frequency (pitch) of which is proportional to the velocity of the moving target.

It is not the real sound made by the fetal heart.

5.3 Heart Rate Processing

The Doppler audio signal is amplified and filtered. It's amplitude is then regulated after passing through a low-pass anti-aliasing filter. The signal is then sampled by the microcontroller in order to calculate the fetal heart rate.

5.4 Fetal Movement Detection (FMD)

The BD4000 and BD4002 will annotate the fetal heart trace towards the top of the contraction channel when a fetal movement is detected.

This movement is derived from low frequency Doppler signals from the Ultrasound Transducer.

The FMD can be enabled via the front panel and its sensitivity set.
Refer to the user manual for further information.

5.5 FECG

As an alternative to using ultrasound to monitor FHR, a FECG scalp electrode may be used.

This makes a direct connection to the fetal scalp and provides more reliable tracking of the fetal heart rate during the later stages of labour.

The FECG transducer incorporates an isolation amplifier which provides electrical isolation between the patient and the monitor.

5.6 IUP

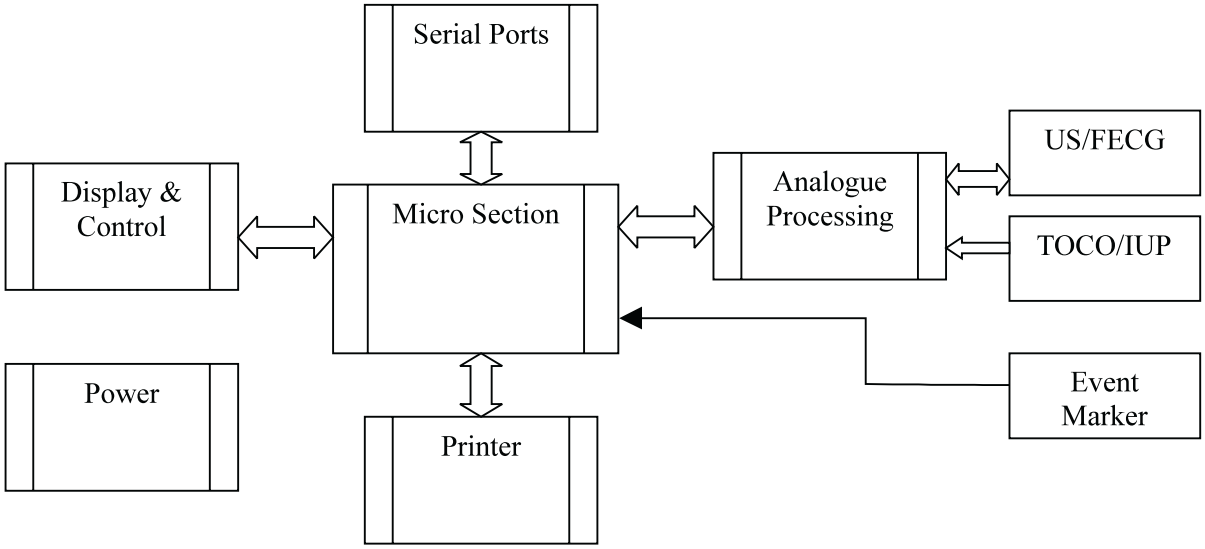
In some markets Intra Uterine Pressure measurements are made as an alternative to the external Toco transducer supplied as standard.

Patient electrical isolation is provided by an adaptor box plugged into the Toco socket and a corresponding waveform is printed on the contractions trace either shown in millimetres of Mercury (mmHg) or kiloPascals (kPa).

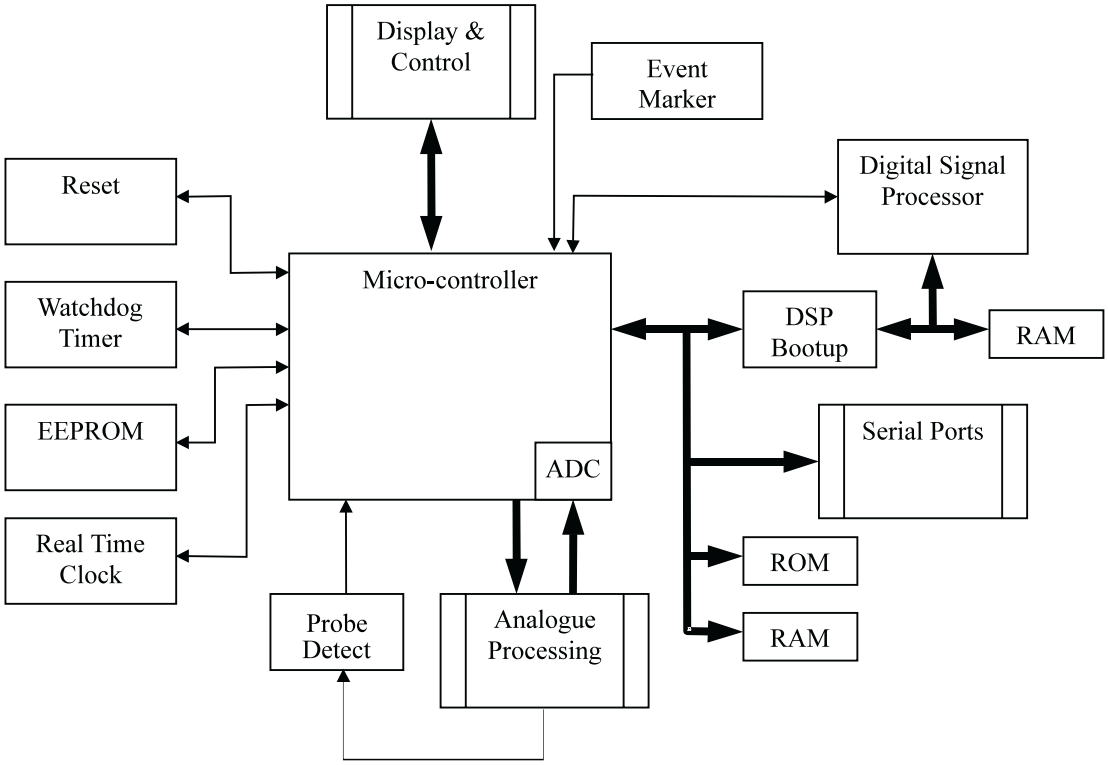
The pressure sensor is either inserted directly into the mother using the Intran Plus IUP 400 Disposable IUP System (Utah Medical Products inc). Alternatively using the SensoNor SP844 pressure sensor and a saline filled catheter system. Refer to user manual for further information.

6 BD4000 overview

The BD4000 has been split up into several sections as shown below for clarity.



6.1 BD4000 Micro Section



Real Time Clock, this enables the micro to display and print the date/time on the trace. User setup information is held within the internal memory of the clock.

Watchdog Timer, this monitors the micro and checks for any system errors. Upon detecting a system error the micro is reset. All controls revert to switch-on settings.

Event Marker, this patient event marker records a mark on the printout in a different place from the clinical event marker accessed via the front panel (see user manual).

Serial Ports, the rear connector PCB supports two D-type RS232 connectors for external interfacing and twins mode communication.

Display PCB, is mounted on the top half of the case moulding and consists of two separate PCBs joined by a short ribbon cable. This PCB also carries the system controls.

ROM, the ROM memory contains the program.

RAM, the main PCB has three RAM IC's, two are used on the Digital Signal Processing section and the third for data processing by the micro.

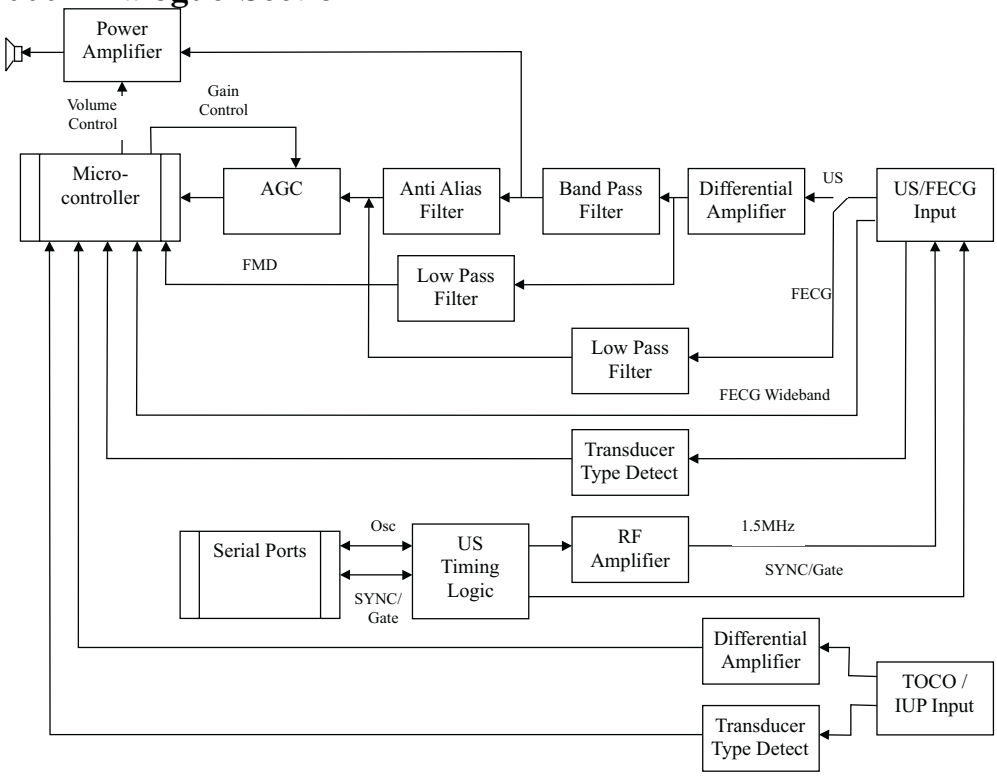
Digital Signal Processor, processes the information from the ultrasound and ECG transducers implementing autocorrelation and ECG detection for deriving the FHR.

DSP Bootup, this circuitry loads the DSP program from EPROM to the DSP's internal RAM when the unit is reset.

EEPROM, used for storage of user setup information when the unit is switched off.

Twins Detect, a link in the cable sets the monitor to twins mode.

6.2 BD4000 Analogue Section



US/FECG Input, balanced signals from the ultrasound transducer are fed into the differential amplifier which converts them to single ended mode.

The US signal is then low-pass filtered and fed to the FMD section for further filtering/amplification and also to the high-pass filter.
This bandpass filtered signal is then level controlled then boosted to drive the speaker. It is also fed through a sharp low-pass anti-alias filter before arriving at the AGC input. This DAC based stage allows the micro to regulate the ultrasound signal before sampling.

US Timing Logic, the master oscillator for the ultrasound system is also located on the main PCB analogue section.

This 1.5MHz carrier is first amplified before being fed to the ultrasound transducer and the rear connector PCB.
The timing logic controlled by the micro sets the ultrasound transmit timing and fully synchronises the system in the twins ultrasound mode.

FECG, the FECG leg plate output signal is low-pass filtered then fed to the AGC circuit. In FECG mode the ultrasound signal is disabled and the AGC used to regulate the FECG signal amplitude before sampling.

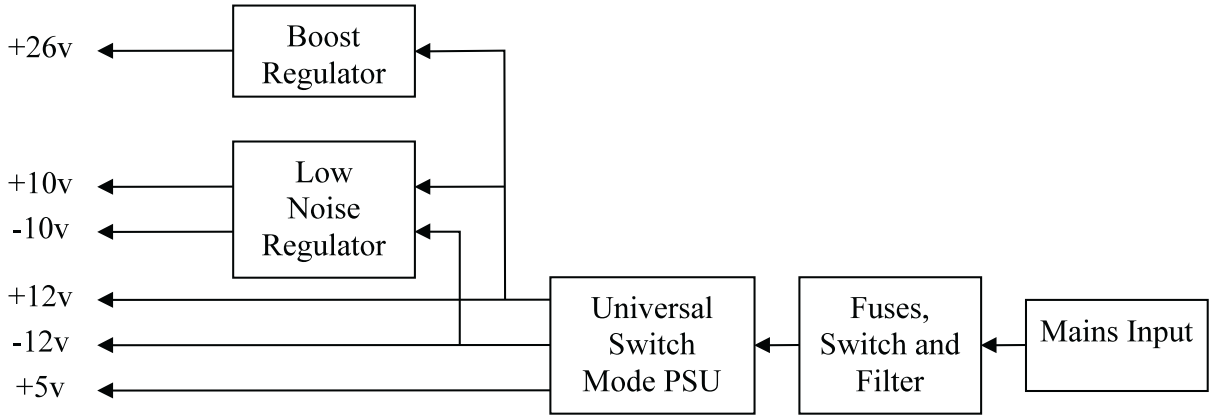
An unfiltered version of the FECG leg plate output signal is also fed to the micro and sampled.

Transducer Type Detect, is used to differentiate between ultrasound and FECG modes.

A probe code circuit detects the connection of an ultrasound transducer and signals this to the micro.
The micro then opens or closes the relevant analogue switches depending on the mode selected, to route the appropriate signals through to the A/D converters.
A similar system is used to detect IUP/Toco transducers.

Toco/IUP Input, a differential amplifier converts the balanced output from the transducer to single ended mode suitable for micro A/D sampling. A sense line detects when an IUP system is connected.

6.3 BD4000 Power Supply Section

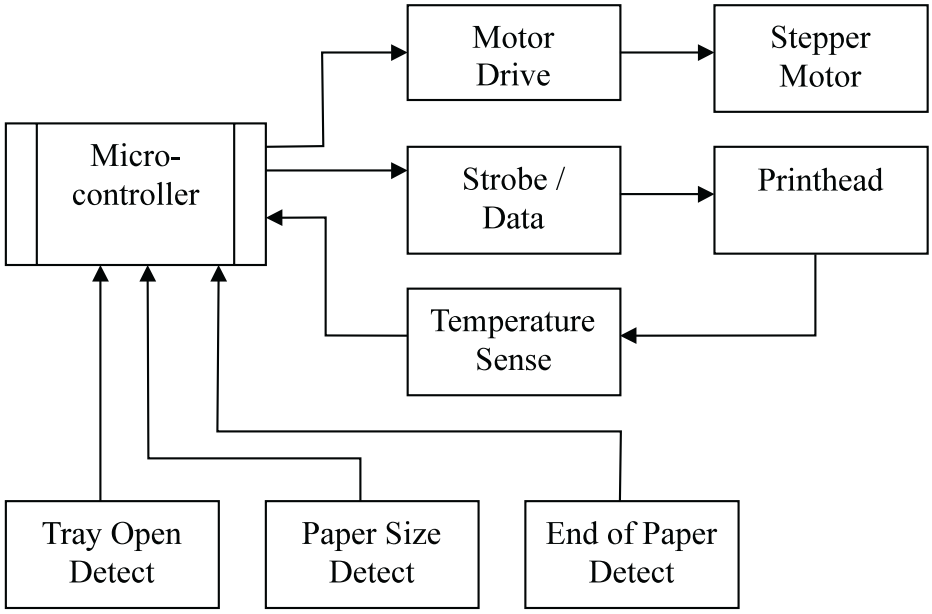


Universal Switch Mode PSU, converts standard international mains power down to +5 and +/-12Vdc.

Boost Regulator, situated on the main board, this converts the +12V to +26V for use by the print head and stepper motor.

Low Noise Regulator, a low noise +/- 10V is also produced to power the ultrasound transducer, anti aliasing filter and automatic gain control circuitry.

6.4 BD4000 Printer Section



Print Head, is a solid state thermal array of heater elements that print onto thermally sensitive paper.

Strobe Control, the strobe control varies the strobe width to the print head, which regulates the intensity of the printout.
The strobe width is controlled by the microprocessor.

Temperature Sense, this allows the micro to assess the temperature of the print head by means of a thermistor in the print head. This will vary as the monitor prints and with ambient temperature.
Strobe width is adjusted to regulate print density.

Stepper Motor Driver, processes the information from the data bus and converts this to a form acceptable to the stepper motor.

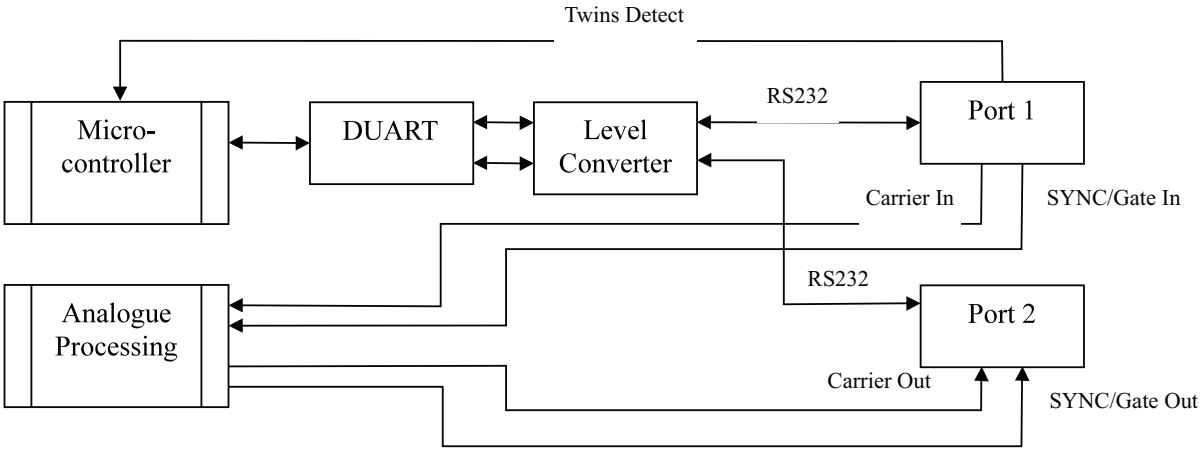
Stepper Motor, drives the printer mechanism.

Paper Width Detector, the paper width switch detects if 150mm or 210mm paper is fitted.

Paper Detector, this detects end of paper. The printer will stop and a message will appear on the LCD when the paper tray is empty.

Tray Open Detector, detects when the paper tray is open and stops printing.
Both sides of the paper tray must be latched shut for normal printing.

6.5 BD4000 Rear Panel Section



DUART, Dual Universal Asynchronous Receive Transmit, controls the data flow to and from the microprocessor and converts it into a protocol accepted by the RS232 IC.

Level Converter, this converts the data from the DUART into RS232 voltage levels. The RS232 link allows data to be passed from and to an external device via the rear panel D-type connectors.

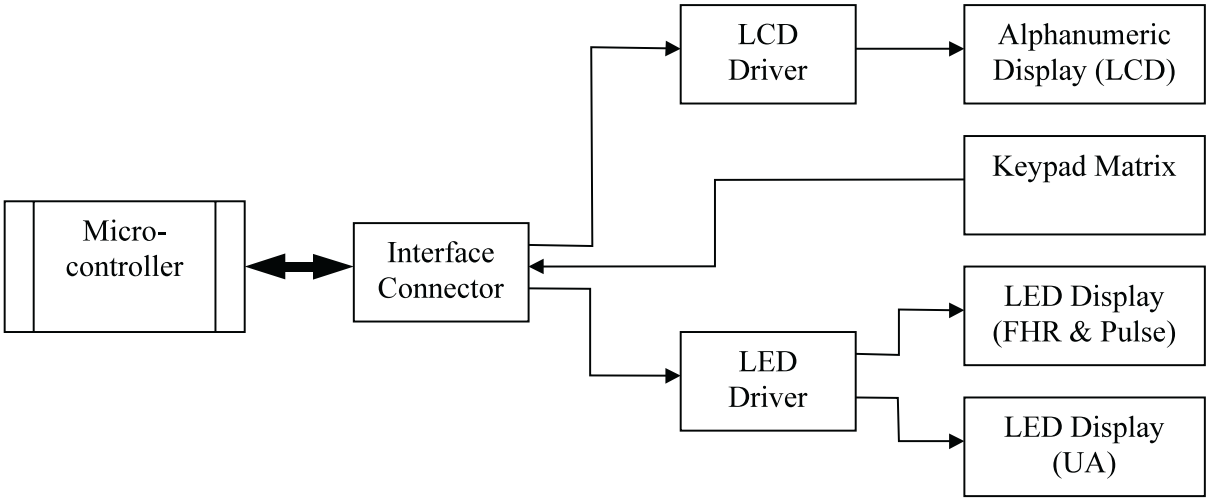
Twins Detect, detects when the twins lead connector marked '1' is connected, to place the unit into twins mode (LOCAL).
The BD4000 connected to the other end of the twins cable becomes the REMOTE unit.

Synchronisation signals, synchronises the two ultrasound transducers when connected in twins mode.

Port 1, when used in twins configuration sets unit to ‘Local’ mode by monitoring Twins Detect. US timing is set by ‘Remote’ unit and FHR information is received from the ‘Remote’ unit.

Port 2, when used in twins configuration sets unit to ‘Remote’. US timing of ‘Local’ unit is set by ‘Remote’ unit and FHR information sent to the ‘Local’ unit for display and printing.

6.6 BD4000 Display PCB



Interface Connector, is the connector from the main PCB.

LCD Controller, processes the information from the data bus and converts this to a form acceptable to the LCD.

LCD Driver, further processes the information from the LCD Controller and data bus for the Display.

LCD Display, 32 character display showing system setup and other information.

Keypad Matrix, this interface enables the user to set up and operate the monitor.

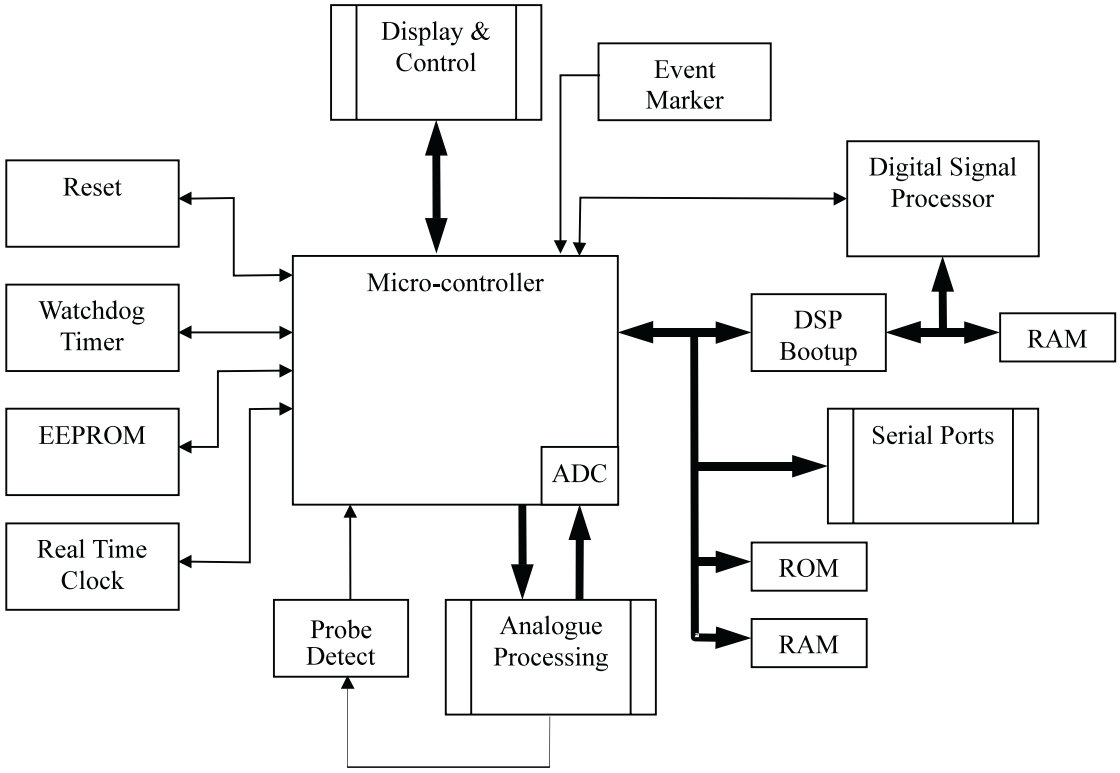
LED Display Driver, manipulates the data from the data bus into a form acceptable to the LED display.

LED Displays, display the Uterine Activity and FHR.

7 BD4002 overview

The BD4002 has been split up into several sections as shown below for clarity.

7.1 BD4002 Micro Section



Real Time Clock, this enables the micro to display the date/time on the trace and front panel. User setup information is held within internal memory of the clock.

Watchdog Timer, this monitors the micro and checks for any system errors. Upon detecting a system error the micro is reset. All controls revert to switch-on settings.

Event Marker, this patient event marker records a mark on the printout in a different place from the clinical event marker accessed via the front panel (see user manual).

Serial Ports, the rear connector PCB supports two D-type RS232 connectors for external interfacing.

Display PCB, is mounted on the top half of the case moulding and consists of two separate PCBs joined by a short ribbon cable. This also carries the system controls.

ROM, the ROM memory contains the program.

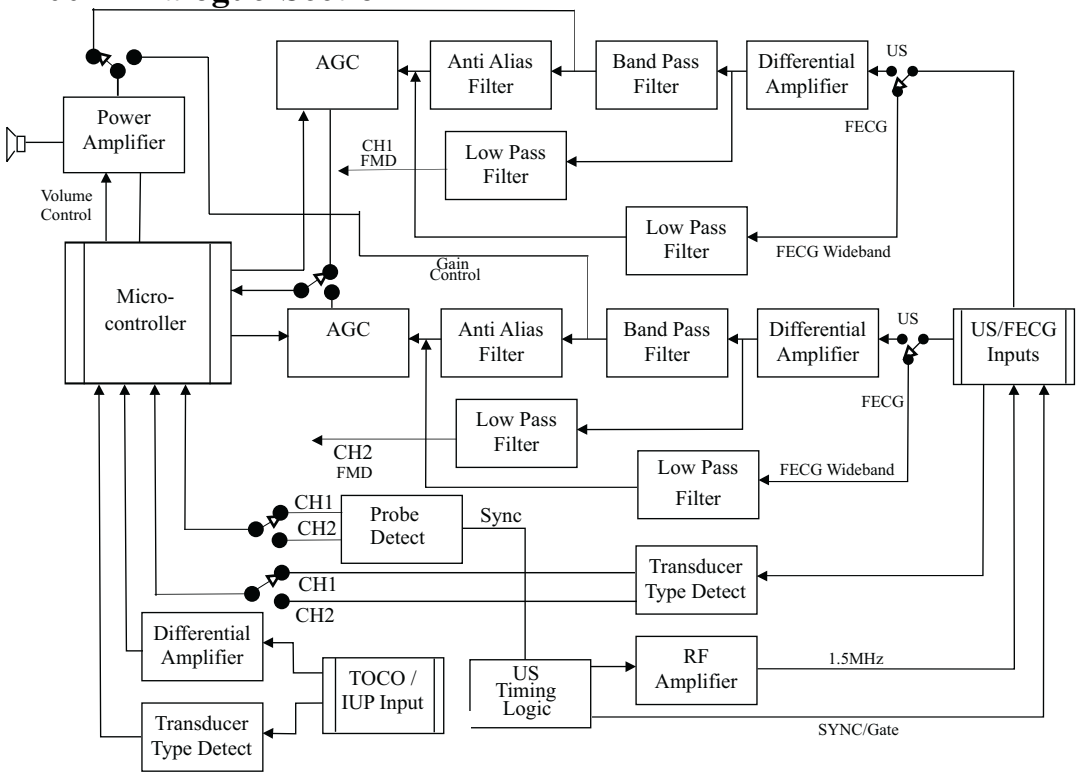
RAM, the main PCB has three RAM IC's, two are used on the Digital Signal Processing section and the third for data processing by the micro.

Digital Signal Processor, processes the information from the ultrasound and ECG transducers implementing autocorrelation and ECG detection for deriving the FHR.

DSP Bootup, this circuitry loads the DSP program from EPROM to the DSP's internal RAM when the unit is reset.

EEPROM, used for storage of user setup information when the unit is switched off.

7.2 BD4002 Analogue Section



US/FECG Input, balanced signals from the ultrasound transducer are fed into the differential amplifier which converts them to single ended mode. This is used on both FH1 and FHR2 inputs.

FHR/FHR2 audio outputs are selected from the display panel when both transducers are utilised

The US signal is then low-pass filtered and fed to the FMD section for further filtering/amplification and also to the high-pass filter.
This bandpass filtered signal is then level controlled then boosted to drive the speaker. It is also fed through a sharp low-pass anti-alias filter before arriving at the AGC input. This DAC based stage allows the micro to regulate the ultrasound signal before sampling.

US Timing Logic, the master oscillator for the ultrasound system is also located on the main PCB analogue section.

This 1.5MHz carrier is first amplified before being fed to the ultrasound transducers.

FECG, the FECG leg plate output signal is low-pass filtered then fed to the AGC circuit. In FECG mode the ultrasound signal is disabled and the AGC used to regulate the FECG signal amplitude before sampling.

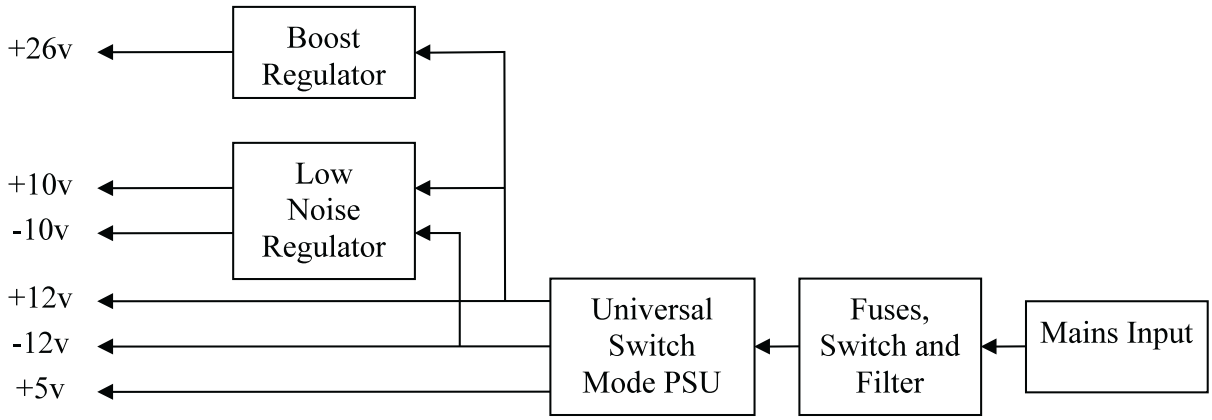
Transducer Type Detect, is used to differentiate between ultrasound and FECG modes.
A probe code circuit detects the connection of an ultrasound transducer and signals this to the micro.
The micro then opens or closes the relevant analogue switches depending on the mode selected, to route the appropriate signals through to the A/D converters.

Probe Detect, detects the presence of one or two US/FECG transducers allowing the micro to monitor the correct channels as required.

Toco/IUP Input, a differential amplifier converts the balanced output from the transducer to single ended mode suitable for micro A/D sampling. A sense line detects when an IUP system is connected.

A probe code circuit detects the connection of an external contractions or IUP transducer and signals this to the micro.

7.3 BD4002 Power Supply Section

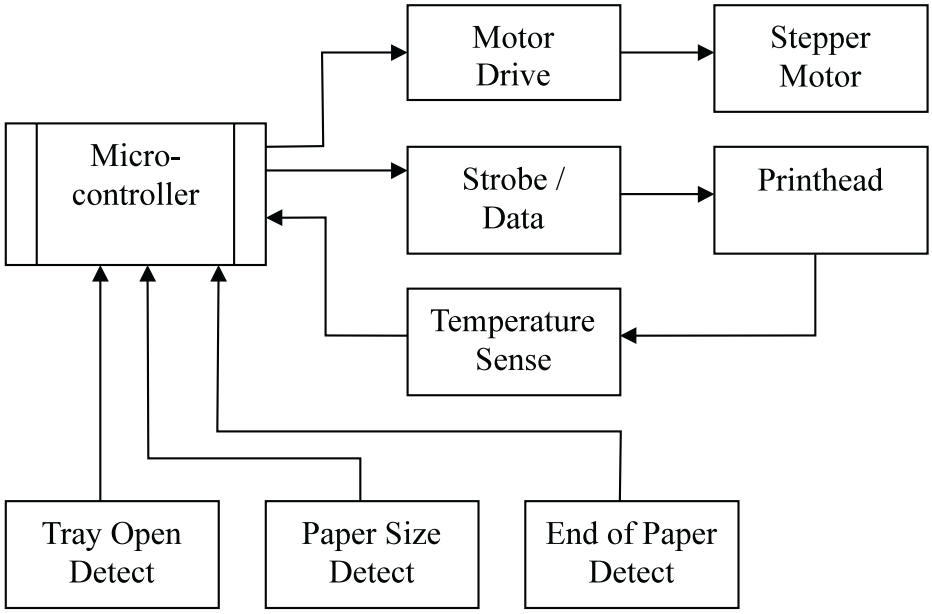


Universal Switch Mode PSU, converts standard international mains power down to +5 and +/-12Vdc.

Boost Regulator, situated on the main board, this converts the +12V to +26V for use by the print head and stepper motor.

Low Noise Regulator, a low noise +/- 10V is also produced to power the ultrasound transducers.

7.4 BD4002 Printer Section



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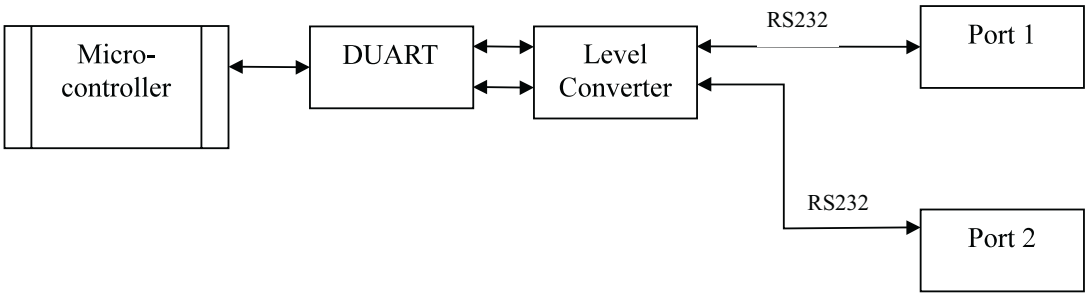
7.5 BD4002 Rear Panel Section



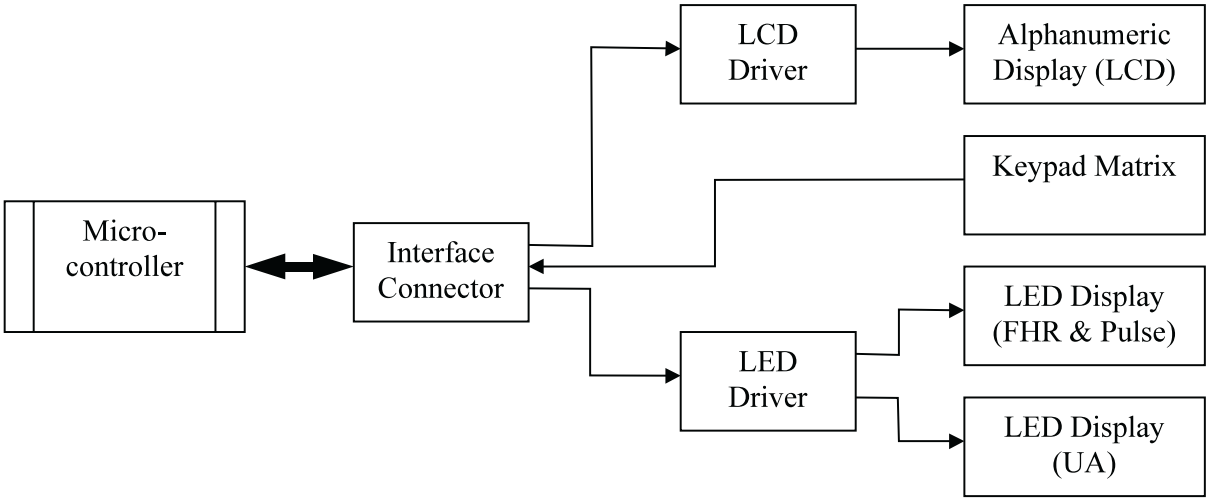
DUART, Dual Universal Asynchronous Receive Transmit, controls the data flow to and from the microprocessor and converts it into a protocol accepted by the RS232 IC.

Level Converter, this converts the data from the DUART into RS232 voltage levels. The RS232 link allows data to be passed from and to an external device via the rear panel D-type connectors.

Port 1, for connection to external devices, (e.g. NiBP/SpO2 monitors)

Port 2, used for communications with central monitoring stations.

7.6 BD4002 Display PCB



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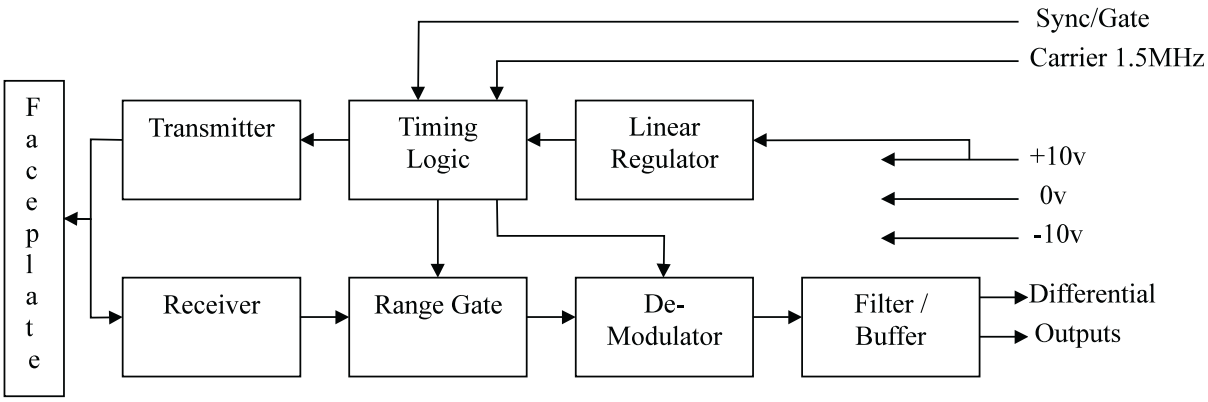
Keypad Matrix, this interface enables the user to set up and operate the monitor.

LED Display Driver, manipulates the data from the data bus into a form acceptable to the LED displays.

LED Displays, display the Uterine Activity and FHRs.

8 BD4000/BD4002 Transducers

8.1 US1 Ultrasound Transducer



Timing Logic, is driven by the control and carrier signals fed from the main unit. This logic controls the transmitter and receiver range gating.

5V Regulator, the 5V regulator is supplied from the +10V line.

Range Gate Control, is used to reject any unwanted signal caused by reflections and contact noise.

Transmitter Output, the output is pulsed, the timing of which is controlled by the timing logic section.

Range Gate Switching, the signal from the ultrasound head is selected by the range gating section to ensure that the receiver circuitry is not enabled during the transmit period, this is switched on after a suitable period to reduce unwanted signals.

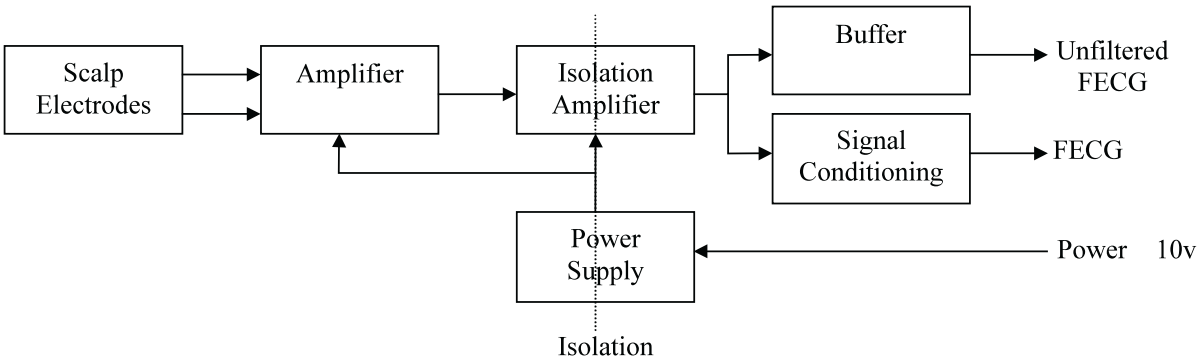
Demodulator, a reference signal from the main oscillator is used to demodulate the received signal.

Filter Network, the output from the demodulator is low pass filtered to remove any unwanted noise.

Output Buffers, to minimise noise, a balanced output is used.

Ultrasound Faceplate, comprises a multi element array with 7 crystals connected in parallel.

8.2 FECG Leg Plate



Patient Connections, these follow the standard three node connection pattern commonly used in FECG monitoring.

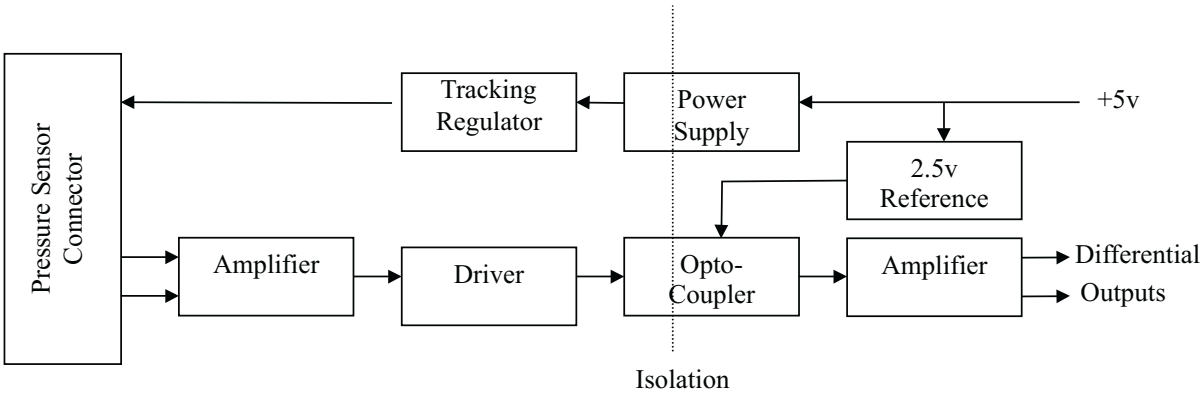
Instrumentation Amplifier, this is used to amplify the FECG signal. An instrumentation amplifier is used as it is very important that this stage has a very high common mode rejection ratio due to the small FECG signal that is presented with large common mode noise and maternal signals.

Isolation Amplifier, to maintain patient safety should an electrical fault occur, an isolation amplifier is used as a barrier to avoid excess leakage through to the patient.

Power Supply, this is used to provide a 15V supply to the isolation amplifier. A +5V supply is derived from the +10V input. The +5V supply is used in conjunction with the -10V line to provide the isolation amplifier with the 15V required.

Signal Conditioning, is used to smooth and amplify the signal from the Isolation amplifier for further processing by the main unit.
The unfiltered signal from the isolation amplifier is also provided.

8.3 IUP Module



Power Supply, provides an isolated supply to the ampifier and electronics in the patient connected part of the IUP system for patient safety.

2.5V Reference, is used to power the opto isolator.

Amplifier, provides amplification of the siganl recieved from the IUP pressure transducer and is fed to the driver for transfer over the opto isolated barrier via the opto coupler.

The second amplifier provides an amplified signal with differential outputs for the fetal monitor to interprete and display.

9 Electrostatic Discharge (ESD) Precautions

9.1 What is Static Electricity?

Static electricity is generated when two materials move against one another. The voltage generated depends on the materials generating the electricity, the speed of movement, humidity and rate of discharge. All man made materials generate static, such as plastic coffee cups, plastic bags, binders and folders, all of which are likely to be within the working area.

Activity	10-20% Relative Humidity
Walking across carpet	35,000 Volts
Walking across vinyl floor	12,000 Volts
Working at bench	6,000 Volts
Plastic folder	7,000 Volts
Poly bag lifted from bench	20,000 Volts
Foam padded work chair	18,000 Volts

Static electricity is generated very easily, and is only felt by us when we discharge the built up charge rapidly by touching a grounded object such as a grounded door handle. The voltages felt by us are as high as 3kV, but only 20V is necessary to damage some components. Voltages as high as 35kV and current spikes of 40A have been known.

The damage to the component, or assembly can be immediate or latent. Latent damage is not immediately obvious but can lead to the circuitry subsequently failing or becoming erratic.

9.2 Protective Measures

To protect devices (ESDs) from the unwanted effects of ESD, two key measures must be taken to minimise the possibility of damage.

1. All sensitive devices and assemblies must be handled in an ESD Protected Area (EPA).

2. All sensitive devices and assemblies must be transported in a protected state.

For further information on static precautions and soldering equipment refer to Appendix A.

10 Servicing Procedures - Main Unit

Due to the complexity of the product and the use of surface mount technology, the electronic circuitry is not serviceable without specialised training and equipment.

The repairs detailed in this manual are therefore limited to replacement of certain parts.

Fault finding is limited to checking for the presence or absence of signals around suspect components using an oscilloscope or multimeter.

Repairs should only be undertaken by suitably skilled service personnel.
Refer to section 2.6.

10.1 Torque Settings

To ensure that the case fixings are not damaged during servicing and that assemblies are securely fixed, it is essential that the torque settings for **all** assemblies are adhered to.

Failure to torque fixing screws correctly may result in damage requiring case replacement and may affect reliability.

The torque setting are detailed in the relevant procedure and listed in Appendix B.

CAUTIONS

This equipment contains static sensitive devices. Refer to Appendix A for recommended anti-static handling precautions. It is essential that these procedures, or equivalent, are adopted to avoid static damage to the circuitry.

Due to the high density tracking and small size of components, extreme care in handling the PCBs must be taken at all times.

When soldering, take care to ensure that minimum heat is applied to the boards and components for the minimum time necessary to ensure high quality joints. Inspect the area around repairs for solder splashes and bridges. Refer to Appendix A for details of recommended soldering procedures.

10.2 Unit Dismantling

Caution: Ensure that mains supply is removed before opening unit

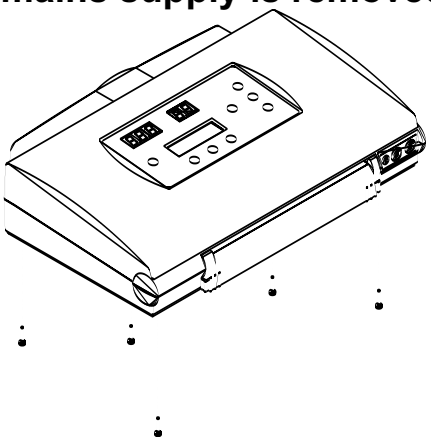


Fig 5 Case Screw Removal

1. Invert unit on a smooth surface and remove 5 case securing screws.
2. Turn unit over and carefully raise the top case half. Unplug front panel ribbon cable and place case half to one side, avoiding strain to the earth wire.

10.3 Unit Reassembly

1. Ensuring that front panel ribbon cable and safety earths are fitted, locate top case over speaker and front panel alignment guides.
2. Invert unit and refit 5 securing screws and tighten to 45cNm.

10.4 Display/Front Panel Switch PCBs Removal

1. Dismantle unit as previously detailed in 7.2.
2. Remove 6 nuts from front panel switch PCB, 3 nuts from display PCB and their nylon washers.
3. Carefully lift PCBs and earth wire (see Fig 11) clear from case assembly.

10.5 Display PCBs Refitting

1. Place PCBs over pillars, fit nylon washers and torque nuts to 20cNm.

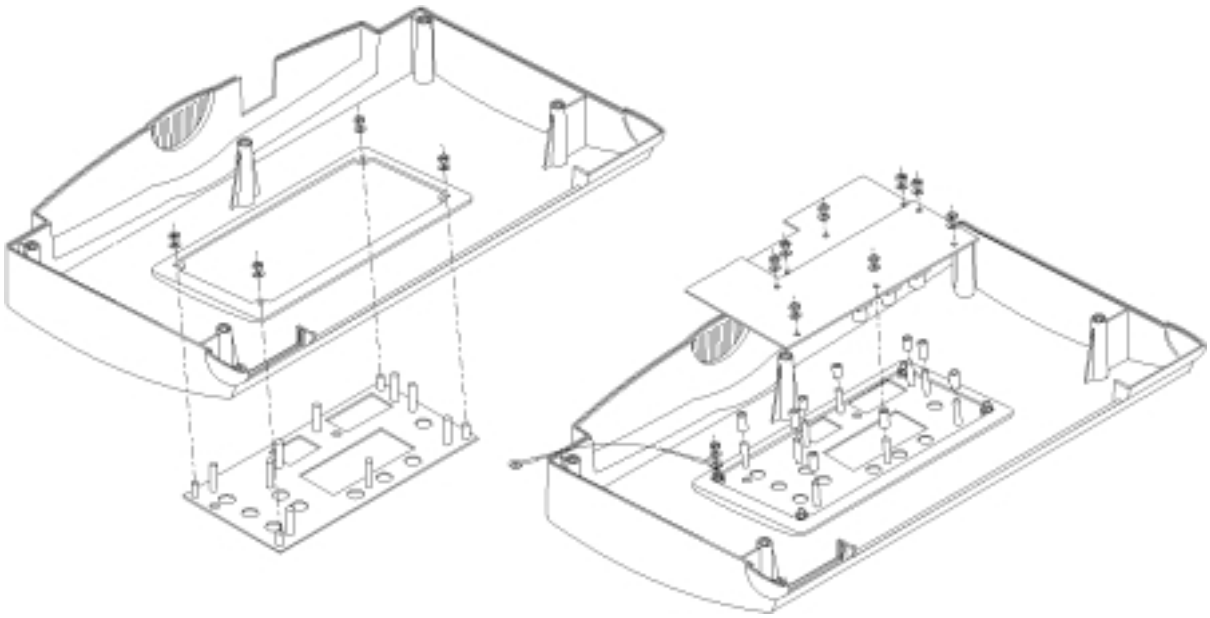


Fig 6 Front Panel Removal

10.6 Display PCB Metalwork Removal

1. Remove Display PCBs as detailed in 7.4.
2. Remove nylon washers and spacers from pillars. Remove remaining 4 retaining nuts and metal washers from metalwork.
3. The front panel metalwork can now be pushed through case moulding cut-out and the label removed.

10.7 Refitting Display PCB Metalwork

1. With case top uppermost, place metalwork in cut-out.
2. Turn case top over, fit metal washers, earth lead (see Fig 11) and securing nuts as shown.
3. Fit washers as Fig 11 and refit display PCBs as detailed in 7.5.
4. Check switch caps, LCDs, LEDs are flush with metalwork, fit label.

10.8 Main PCB Removal

1. Remove print head connector, taking care not to short pins together. Remove all connectors as shown in fig 12 below.

2. Remove 4 nuts and washers at each corner of PCB.

10.9 Main PCB Refitting

1. Place PCB over pillars, fit washers and nuts as above. Torque retaining nuts to 20cNm and fit shakeproof washer under earthing point nut.

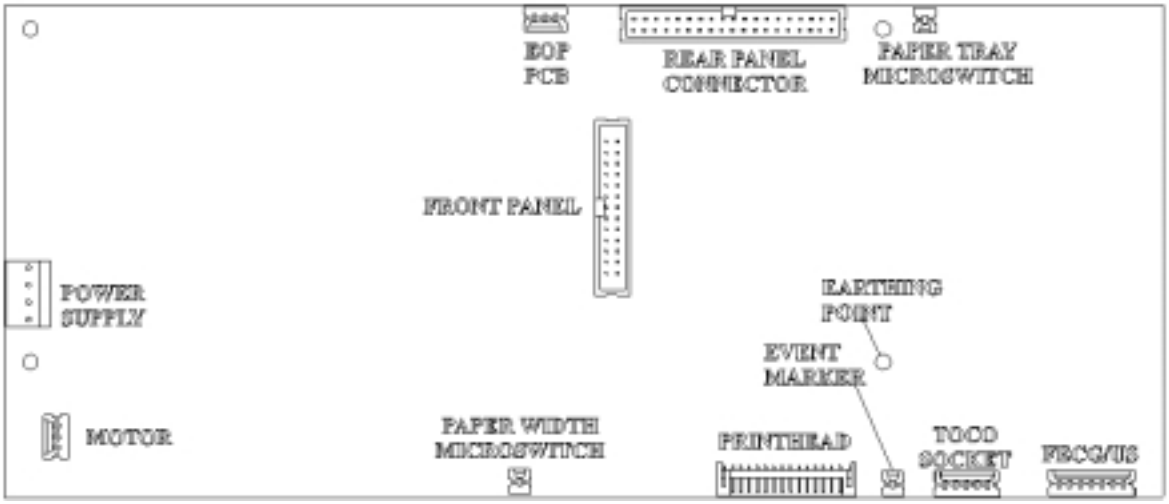


Fig 12 Connector layout

2. Replace all connectors as above.

10.10 Print Head Removal

1. Remove print head connector, taking care not to short pins. Pull out paper tray, remove 4 head support plate screws, motor support plate and earth lead.

2. Remove 2 x M3 nuts from head support plate and lift head support plate clear of head. Remove springs and spacers.

3. Remove 6 screws, head mounting plate and print head connector.

10.11 Print Head Refitting

1. Fit print head connector, head mounting plate and tighten 6 screws to 35cNm. Ensure that print head is parallel to head mounting plate.

2. Place spacers over pillars and springs over spacers.

3. Place head support plate over head mounting plate ensuring that metal tongue is located under screw head as fig 13.

4. Push print head support plate past pillars, fit plain washers over pillars, tighten nuts to 35cNm. Ensure that print head support plate and head mounting plate are free to slide up and down spacers.

5. Place print head assembly over mounting pillars and screws. Align print head as detailed in 7.12.

10.12 Print Head Alignment Procedure

Warning - Shock Hazard

Extreme caution must be taken while working in live equipment, ensure that earthed case does not contact live parts. Also note that parts of the power supply are live.

1. With print head assembly screws tightened lightly and ribbon cable connected, pull print head towards front of unit and close paper tray.

2. Ensure that front panel ribbon cable is connected to main PCB and connect mains supply to inlet socket.

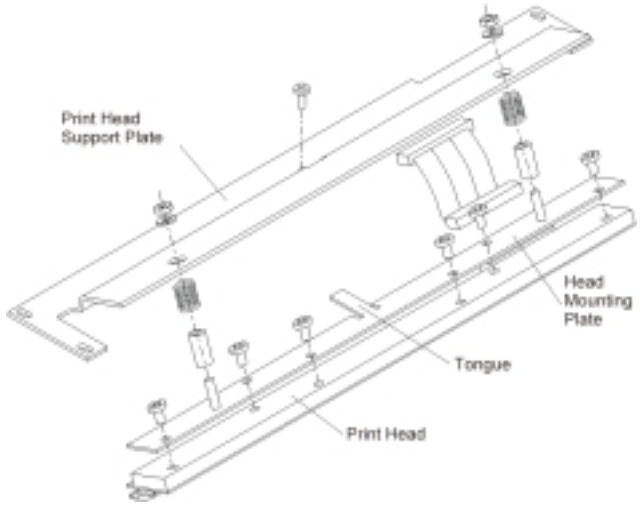


Fig 13 Print Head Assembly

3. Start unit printing at 3cm/minute and slide print head towards case rear until print density is acceptable. Refer to 8.4 for setup test pattern.

4. Remove mains supply and tighten head support plate screws to 35cNm.

10.13 Stepper Motor Removal

1. Disconnect stepper motor connector. Remove print head assembly as detailed in 7.10 and cable ties to printhead securing plate.

2. Remove stepper motor assembly clear of monitor. Remove stepper motor mounting plate screws and remove mounting plate.

10.14 Stepper Motor Refitting

1. Fit Stepper motor to mounting plate, passing gear through mounting bracket noting cable orientation and tighten screws to 60cNm.

2. Insert stepper motor assembly to base, fit earth lead, motor support plate and screws, tighten loosely. Secure cables using cable ties.

3. Fit print head as per 7.11 and close paper tray.

4. Align motor gears with roller gears ensuring gears mesh allowing small amount of backlash, see fig 14.

5. Tighten screws to 60cNm.
   Fit stepper motor connector and align print head as per 7.12.

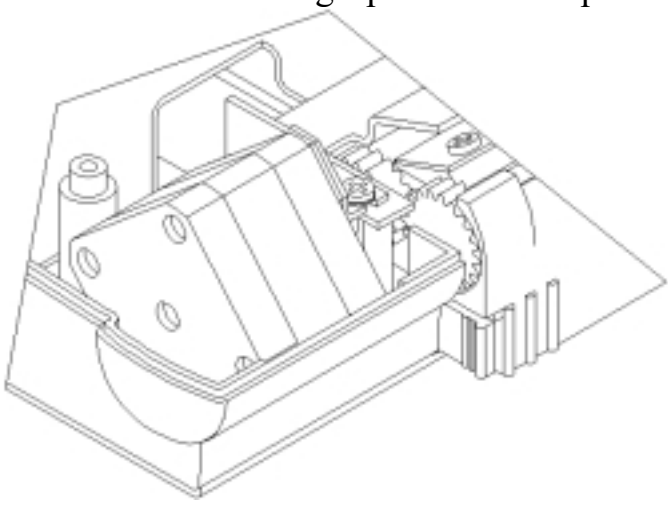


Fig 14 Gear Alignment

10.15 Power Supply Removal

Caution: Ensure that mains supply is disconnected before removing Power Supply Board

1. Remove power supply connectors noting orientation and connector types.
2. Remove 4 retaining nuts and washers. Lift Power Supply Unit clear from assembly.

10.16 Power Supply Refitting

1. Refitting is reversal of removal, ensure that the PSU base insulator is fitted with largest hole at the rear left hand side of the power supply.

10.17 Mains Inlet Removal

Caution: Ensure that mains supply is disconnected before removing Power Supply Board

1. Remove Power Supply Unit connectors.
2. Remove cable ties and disconnect safety earth.
3. Remove Power Supply Unit to mains inlet wiring.

10.18 Mains Inlet Refitting

1. Fit Power Supply unit to mains inlet wiring and secure wiring using cable ties. See fig 15.
2. Fit safety earth.

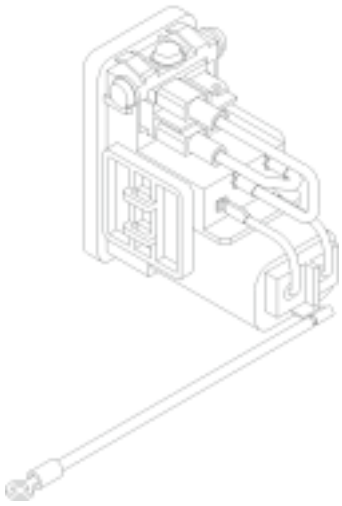
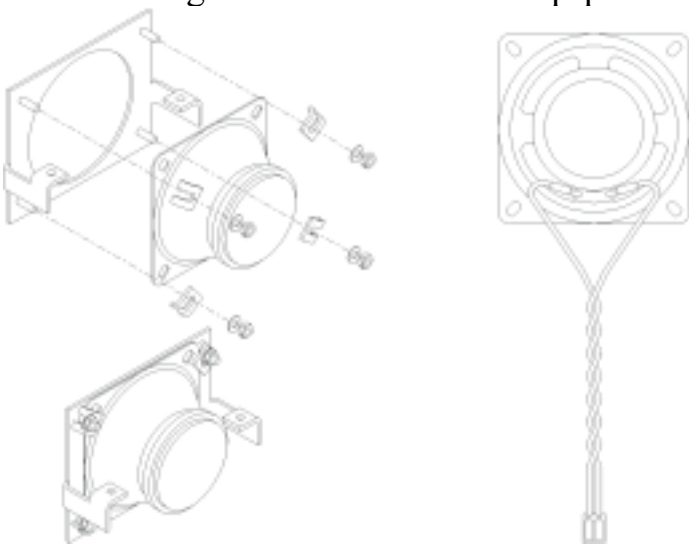


Fig 15 Mains Inlet Detail

10.19 Speaker Removal

1. Remove speaker connector from rear panel PCB.
2. Remove 2 Speaker bracket securing screws, lift speaker assembly and earth wire clear of unit.
3. Remove 4 speaker securing screws nuts and clamp plates.



10.20 Speaker Refitting

1. Refitting is reversal of removal, tighten screws and nuts to 35cNm.

10.21 Rear Panel Connector PCB Removal

1. Remove rear panel ribbon cable from main PCB.
2. Remove 2 PCB retaining screws.

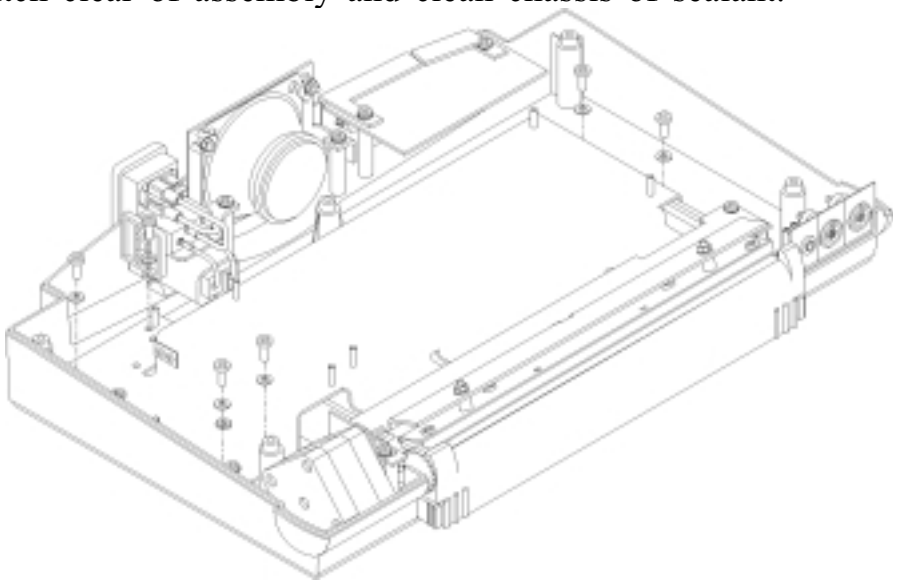
10.22 Rear Panel Connector PCB Refitting

1. Place rear panel PCB over mounting pillars ensuring that the earthing fingers are meshed correctly.
2. Fit screws and washers, tighten to 35cNm. Fit ribbon connector to main PCB.

10.23 Paper Tray Open Microswitch Removal

1. Remove microswitch connector and power supply as detailed in 7.15.

2. Remove microswich and plate securing screws. Removing one screw at a time will prevent the securing plate from dropping under the chassis. Lift microswitch clear of assembly and clean chassis of sealant.



10.24 Paper Tray Open Microswitch Refitting

1. Place microswitch over securing plate and fit screws loosely.

2. With paper tray fully closed adjust microswitch position to register paper tray closed.

3. Pull the left hand side of the paper tray gently, the unit may display “Paper tray open” briefly as the paper tray is held under tension, this message must disappear when released.

4. The switch must detect as soon as the left hand side catch is depressed and the tray released.

5. Tighten microswitch securing screws to 35cNm.

10.25 Paper Tray Removal

1. Remove Power Supply PCB as per 7.15. Remove 6 chassis mounting screws and disconnect stepper motor plug.

2. Remove print head support plate as detailed in 7.10 steps 1-2. (Cont’d)

3. Lift print head assembly and chassis from inside paper tray. Pull paper tray forward clear of assembly.

10.26 Paper Tray Refitting

1. Lift print head assembly and chassis. Insert paper tray ensuring that the paper tray is located within the base tray guide.

2. Carefully refit chassis screws and tighten to 60cNm, seal with M-Coat-D. Refit Power Supply Unit as detailed in 7.16. Align microswitch as detailed in 7.24

3. Refit print head support plate as per 7.11 step 5 and align print head as detailed in 7.12.

10.27 Paper Width Microswitch Removal

1. Remove main PCB as detailed in section 7.8
Remove 2 securing nuts, washer and lift switch clear of assembly.

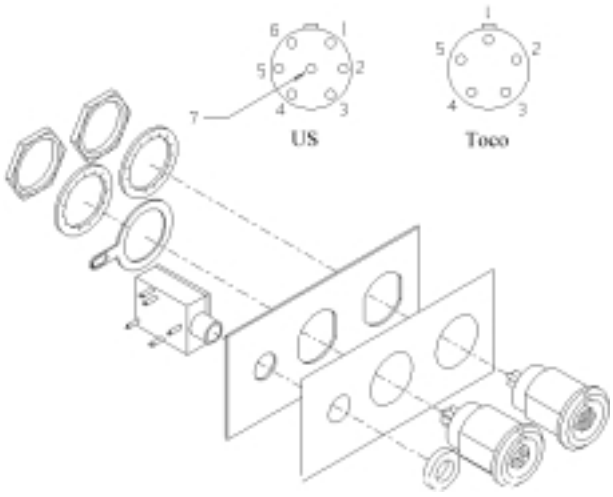
10.28 Paper Width Microswitch Refitting

1. Refitting is the reversal of removal, ensuring paper tray is fully open during refitting procedure.

10.29 Front Panel Connector Assembly Removal

1. Remove event marker, toco and US/FECG connectors from the main board and remove cable ties.

2. Lift front panel connector assembly clear.



Pin No	Toco	Ultrasound
1	Orange	Red
2	White	White
3	Violet	Yellow
4	Black	Violet
5	Yellow	Brown
6	-	Orange
7	-	Black

10.30 Front Panel Connector Assembly refitting

1. Refitting is the reverse of removal. Take care not to damage the earthing fingers. Renew cable ties.

10.31 Toco/Ultrasound Transducer Dismantling

1. Remove the 5 screws from rear of transducer (one under label). Invert case assembly and lift top clear, care should be taken not to lift seal clear at this stage.

10.32 Reassembly of Toco/Ultrasound Transducer

1. Ensure that seal is located in case before fitting transducer top and that seal assembly is fitted correctly.

2. Fit transducer top and tighten screws to 20 cNm. Replace label.

☞ ***Water resistance of US transducers can only be ensured if the units are returned to Huntleigh Diagnostics for refurbishment.***

10.33 Strain Gauge Assembly Removal

1. Remove case top as detailed in 10.31 and desolder grey cable from termination PCB. Desolder strain gauge wires from PCB.

2. Remove 2 securing screws from strain gauge PCB and lift clear from assembly.

10.34 Strain Gauge Assembly Refitting

1. Fit strain gauge assembly noting orientation.

2. Solder wires to termination PCB and tighten screws to 40 cNm. Solder connector cable to termination PCB. Align transducer as per 10.35.

10.35 Toco Transducer Alignment

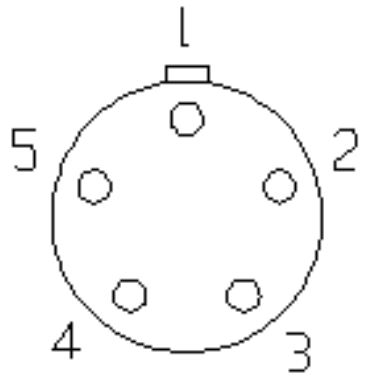
Equipment required

a) Power Supply

b) Digital Volt Meter

c) Weight - 1 x 100gm

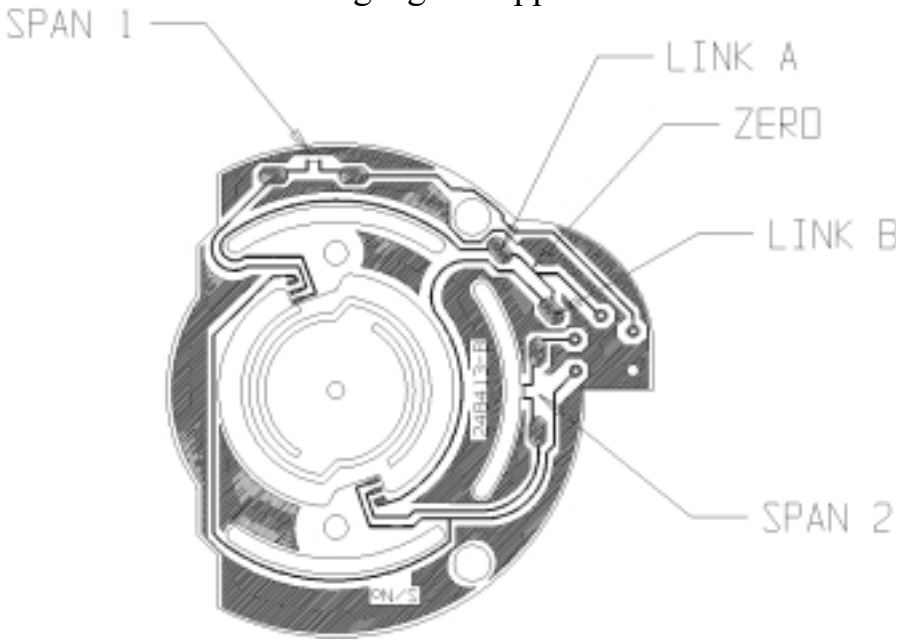
1. Remove case top as detailed in 10.31.
2. Set up power supply voltage to 5.00Vd.c. +/-0.05V.



View from rear of socket

Pin No	Connection
1	5V Supply
2	-
3	GND
4	+Ve O/P
5	-Ve O/p

3. Connect transducer to power supply and DVM as shown in table above.
4. Turn transducer so that strain gauge is uppermost.



5. Apply power to strain gauge and allow 1 minute to settle. Use a toco socket connected as shown above to supply strain gauge and read values.

6. DVM should read zero +13 to +23mV.
   If offset positive, check that link `A' is cut and link `B' intact. Replace `Zero' resistor with new value as required to bring the offset within specification.
   If offset negative, check link `A' is intact and link `B' is cut. Repair cut link with tinned copper wire as required. Allow time for resistor to cool and readings to settle.

7. Place 100g weight on strain gauge button, observe DVM.
   DVM should read 38.9 - 42.1mV.

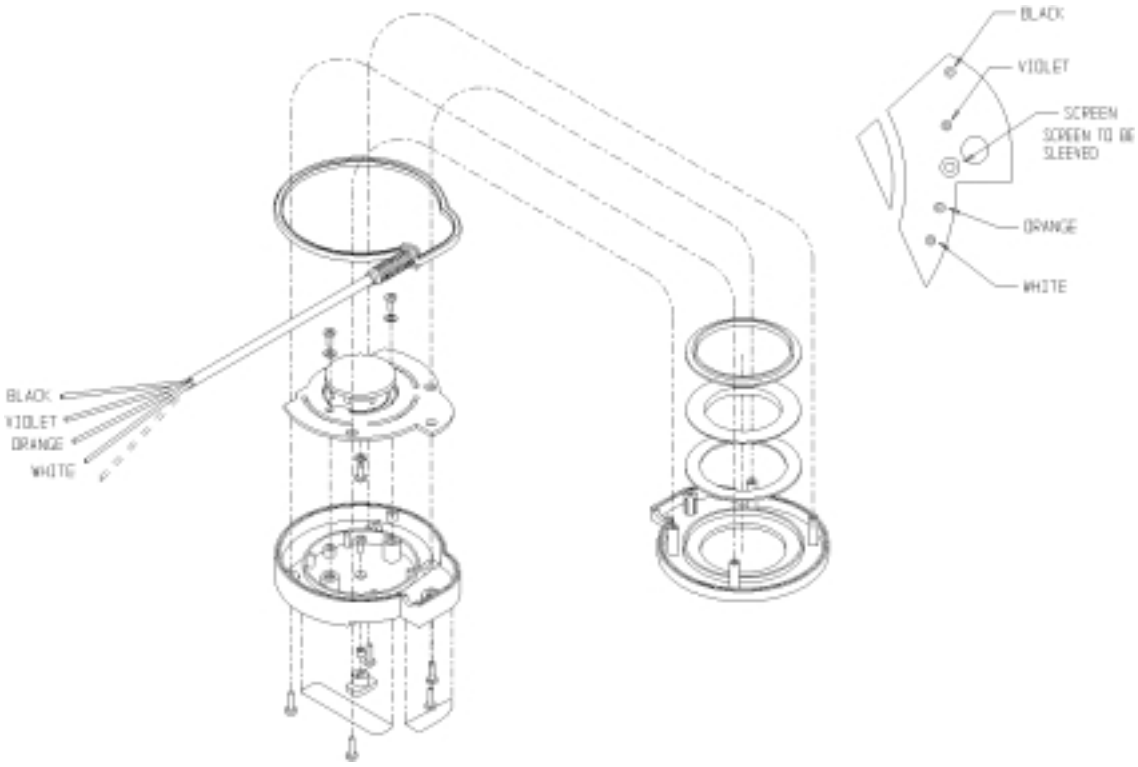
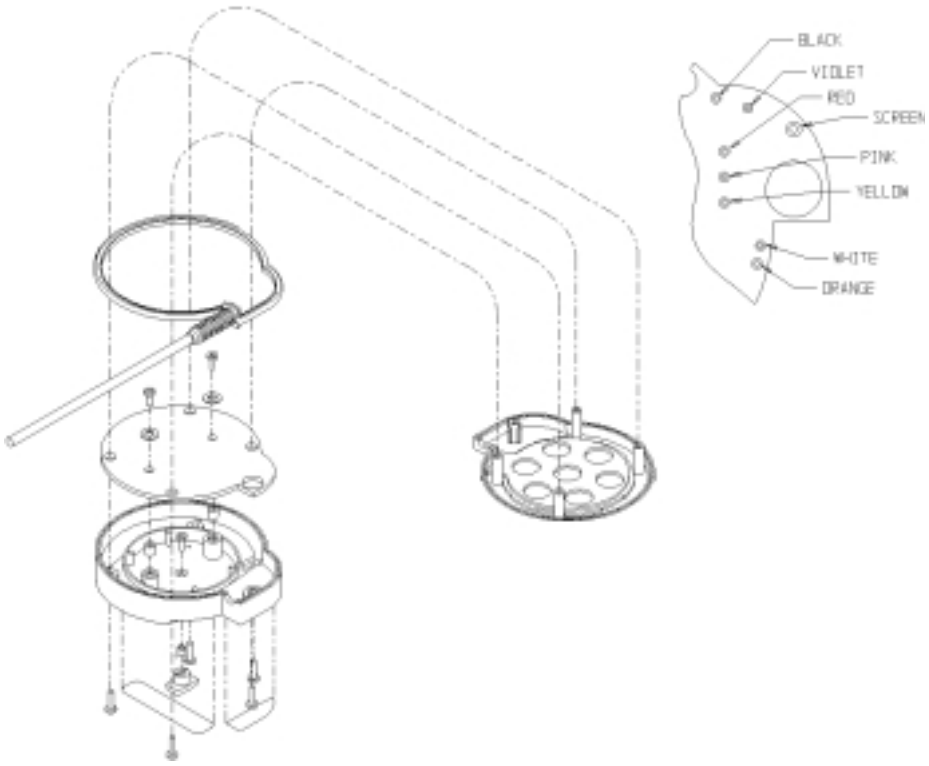


Fig 17 Toco Transducer Assembly



8. Change the value of span resistors and repeat until within specification, both span resistors should be of the same value.
   If the sensitivity is low, decrease the value of both resistors.
   Allow the resistors to cool before repeating process.

9. Assemble the transducer as detailed in 10.34 and check zero value is +5 to +15mV when assembled.

10.36 Replacing Transducer Cable

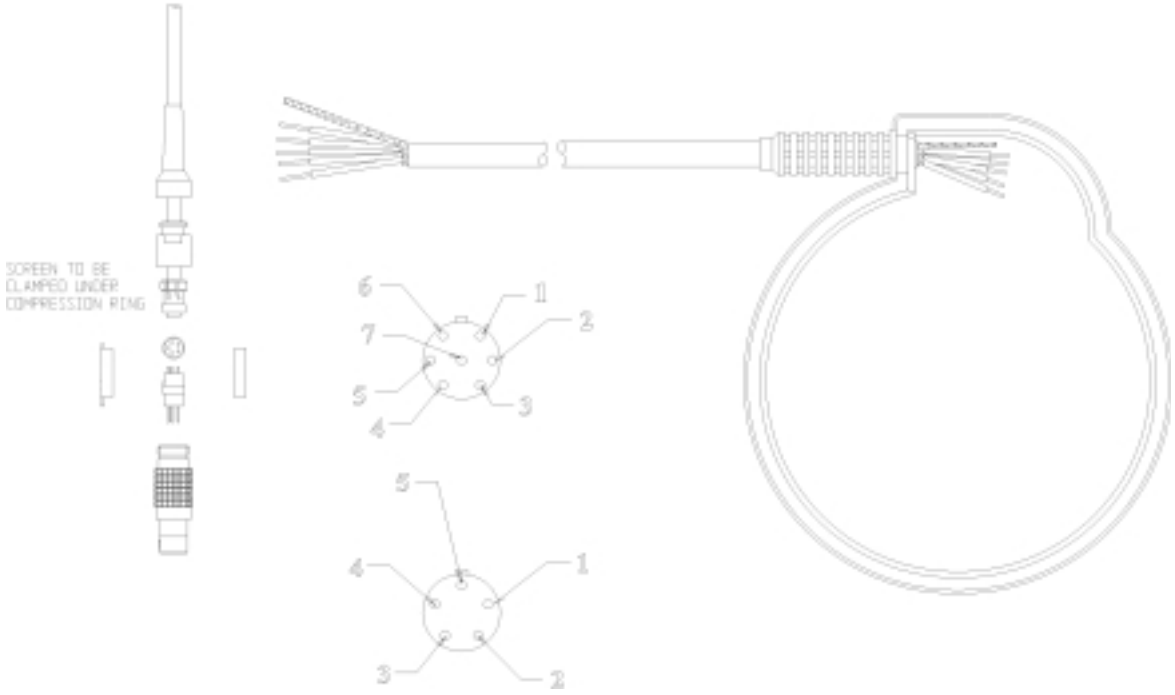
1. Remove case top as detailed in 10.31 and desolder cable from PCB.

2. Unscrew back of metal plug and pull insert free. Desolder wires and remove plug from cable.

3. Fit plug shroud to cable and attach collet. Solder wires to plug as shown in Fig 19.
   Apply threadlock to plug body and tighten assembly.

   ☞ ***Water resistance of US transducers can only be ensured if the units are returned to Huntleigh Diagnostics for refurbishment.***

4. Solder wires to PCB as per Fig 17/18.
   Assemble the transducer as detailed in 10.32.



Pin Number	Toco	Ultrasound/FECG
1	Orange	Orange
2	-	Pink
3	Black	Purple
4	Violet	Yellow
5	White	White
6	-	Red
7	-	Black

There are no serviceable parts within the US transducer and repairs are limited to the replacement of the cable.

10.37 FECG Transducer Servicing

Contact Huntleigh Diagnostics Service Department for further information on servicing the FECG transducer.

11 Fault Finding

In the event of the **BD4000/BD4002** developing a fault, the following checklist should be followed.

Symptom	Possible Cause - check
Unit dead	Fuses in mains inlet blown or PSU
	Fault codes on printout - see section 11.1
	No outputs from PSU
No Audio	Volume level low
	Test with known good ultrasound transducer
	BD4002, check correct channel selected if two transducers fitted.
Not printing - paper driven	Paper wrong way up. Refit paper pack ensuring that the shiny side is uppermost, this sensitive side can be easily marked with a fingernail
	Print head alignment
	Print head dirty
Not printing - paper not driven	Paper tray incorrectly shut
	Printer roller gear incorrectly engaged
US transducer dead	Check transducer cable
	Check twins cable if used
Twins mode not working	Check twins cable/sockets
	Check address set to 10 on both units. See section 11.3

11.1 Error Codes

Under certain fault conditions the BD4000 will print error codes relating to faults within certain sections of the circuitry.

When an error is detected and is first switched on, a printout will automatically be generated as shown below. The unit will then 'shut down.'

Line No	Description	Comment
1	PCB S'No, date of manufacture	Factory preset
2	**S**oft**w**are version	Factory preset
3	**L**anguage 1 (English), **S**cale 20 beats/cm, grid on, **C**hart 3cm/min, **M**ode (internal use only)	User selectable
4	Current Time	User selectable
5	Current Date	User selectable

```
614M00051 210897
SW 11317
L1 S20 G1 C3
TIME  08:19:52
DATE  27/05/98
POWER 00171:08
PRINT 00017:23

EVENTS :-
 EPIDURAL TOP-UP
 EPIDURAL
 PETHIDINE
 SYNTOCINON
 OXYGEN
 VAGINAL EXAM
 TREATMENT
 MOTHER MOVED
 TOCO TDR MOVED
 US TDR MOVED

SERVICE :-
```

The error codes on the bottom of the printout indicate the following;

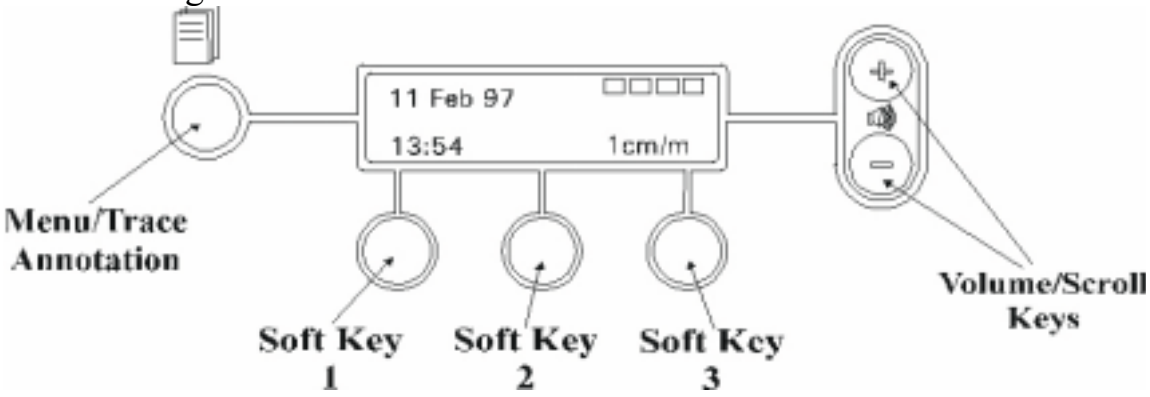
```
ERROR 0 ADDR 010
```

Error Code	Possible Cause
0	No fault
1	Boot failure on DSP
2	Ram U10 - U11
3	Ram U10
4	Ram U11
5	Real Time Clock Battery

11.2 Service Notes

References to servicing information can be stored within the BD4000's memory.

This can be changed as shown below:



Front Panel Button Layout

11.3 Displaying Status

a) Turn unit on and press menu key, then button 1.

b) Press the printer button.

c) The setup information shown on previous page is then printed. The unit then returns to normal use.

Further diagnostic settings can be set as follows;

d) Turn unit on and press setup key(1).

e) Press printer and button 3 simultaneously.

f) Press button 3 until code 14 is displayed.

Then select one of the following options;

g) Using volume +, select test code 0.

h) Press button 3 to select test code 1.

i) Press menu button(1).

j) Start unit printing at the desired speed to print test grid. Remove power from unit to return to normal operation.

Real time clock battery, bed number, address

g) Using Volume +, select desired option.

h) Using keys under LCD change setting.

i) Press menu button to escape or save as appropriate.

11.4 Print Head Test

A series of narrow stripes can be printed, this can be used as an aid to print head alignment, this can be accessed as detailed in 8.3 steps a-f above.

11.5 Bed number

During normal operation the bed number is printed alongside the Huntleigh Diagnostics footnote.

This can be changed as detailed in 8.3.

11.6 Real time clock battery

The real time clock battery can be disabled as detailed in 8.3.

This allows the life of the battery to be extended while in storage. The battery should normally be turned on.

11.7 Address

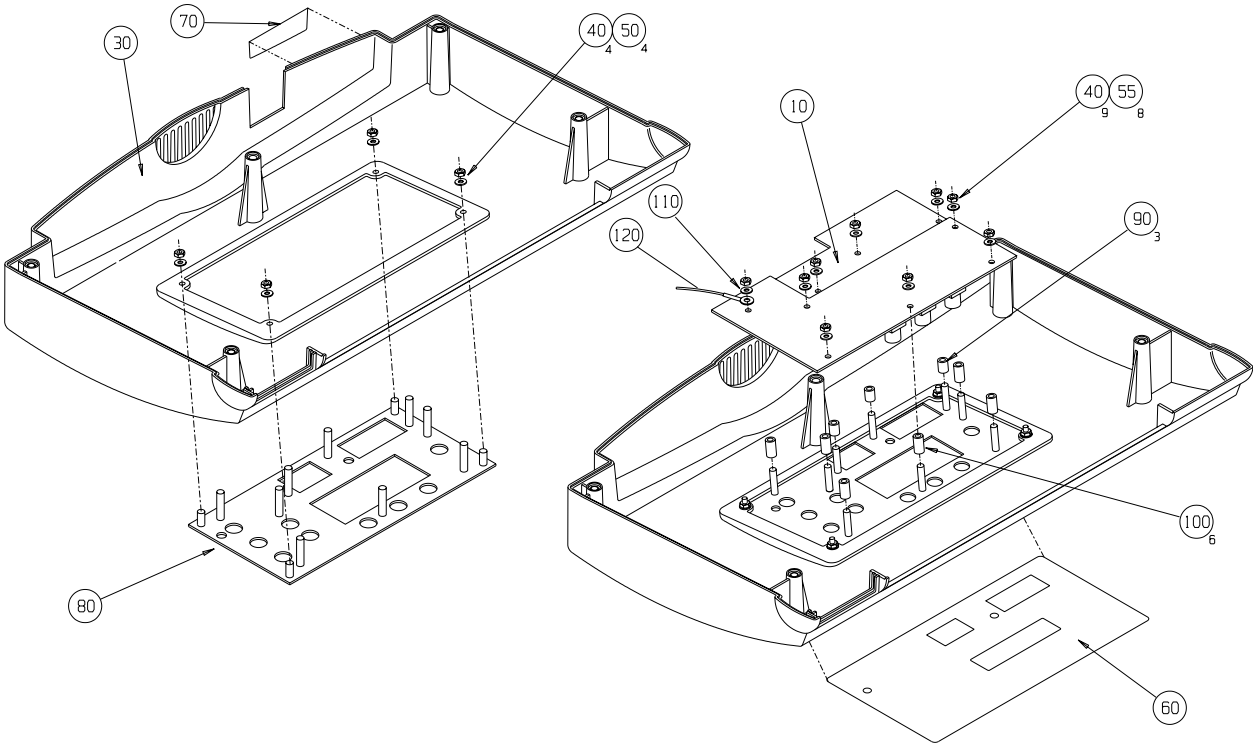
The address of the monitor may be changed, however this is only used during factory testing and must remain set to 10 for twins mode to function (BD4000 only).

12 Spare Parts List

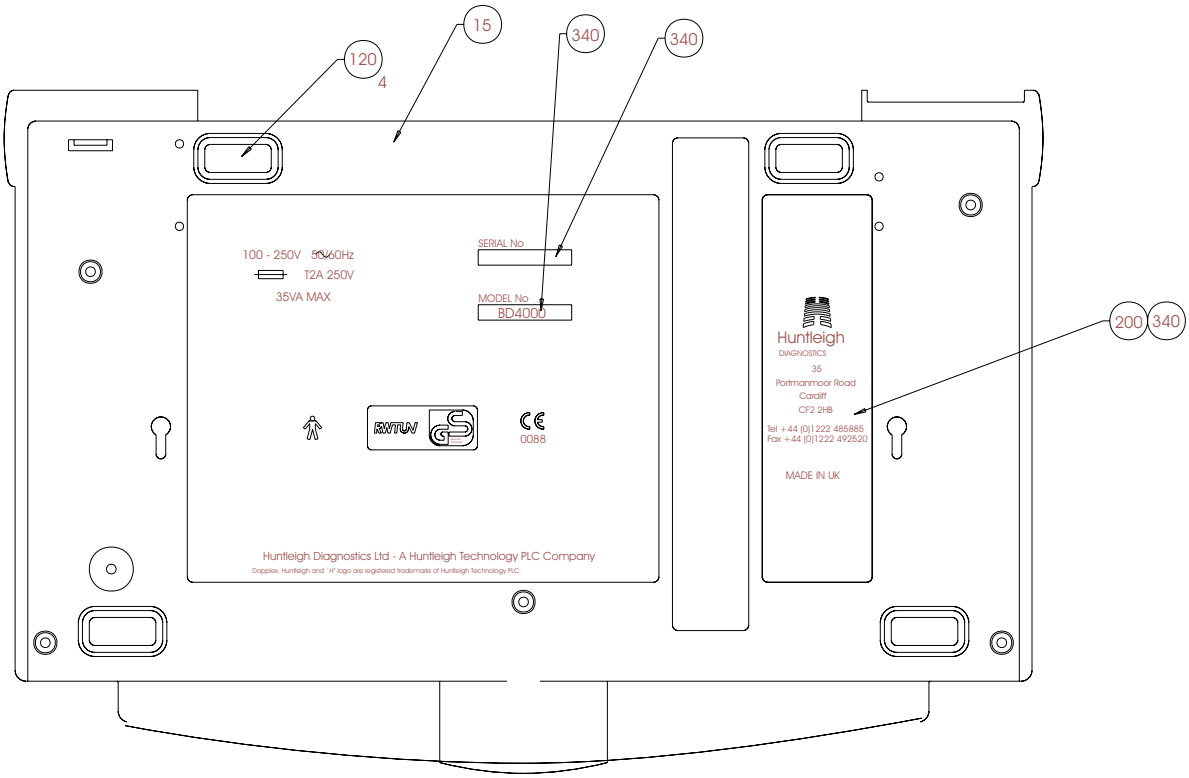
The following spare parts can be ordered from your dealer, or direct from Huntleigh Diagnostics using the part numbers shown overleaf:

12.1 Recommended Spare Parts

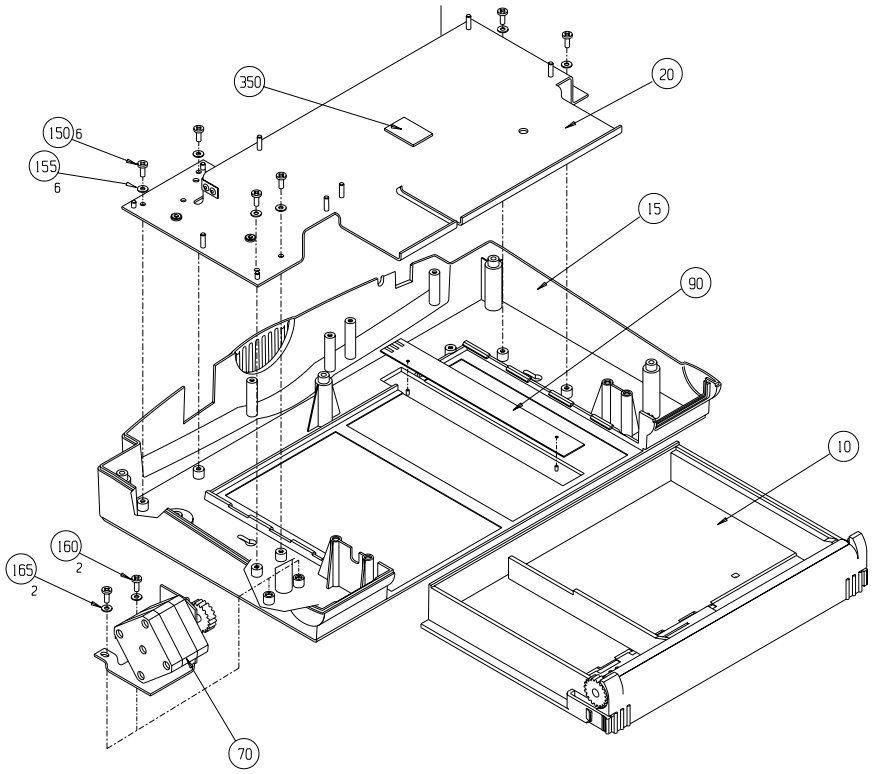
Recommended spare parts are marked with a bold part number.



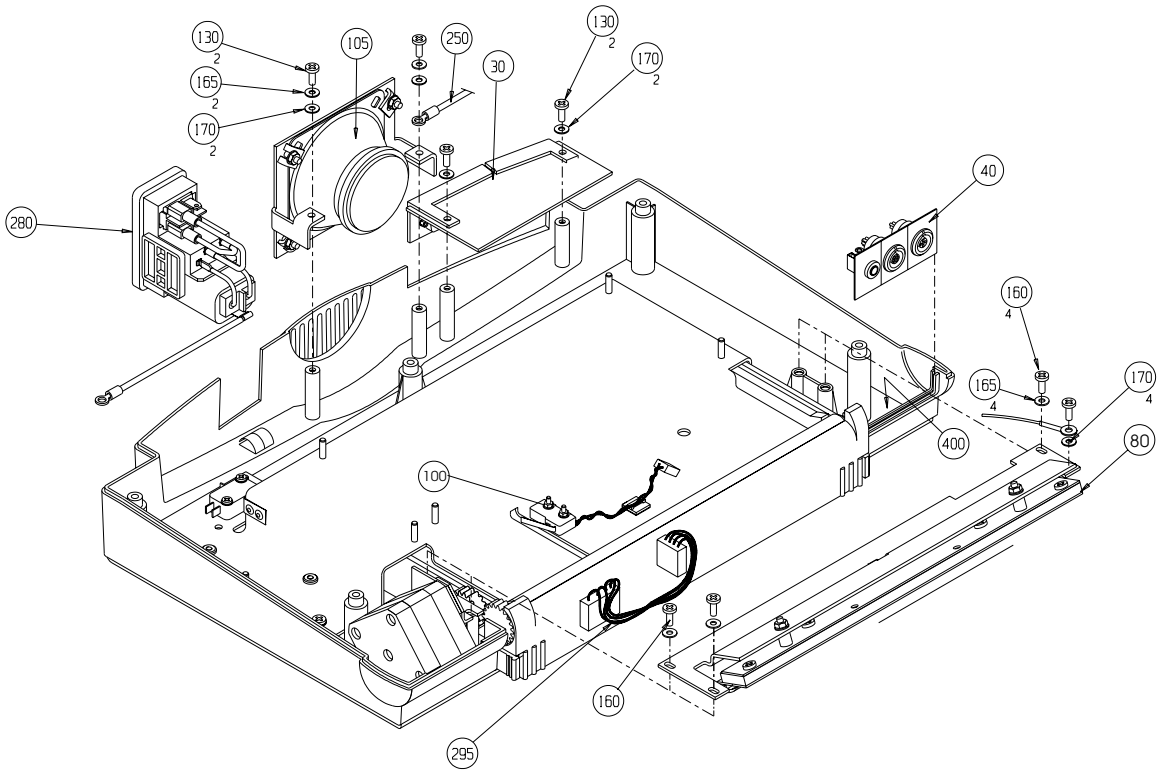
Ref.	BD4000 Part	BD4002 Part	Description
10	614384		DISPLAY PCB
30	614385	614385	TOP COVER MOULDING
40	M3-NUT	M3-NUT	M3 NUT
50	M3-WASHER	M3-WASHER	M3 WASHER
55	M3-WASHER-N	M3-WASHER-N	M3 WASHER - NYLON
60	614386		DISPLAY PANEL LABEL
70	614387		REAR PANEL LABEL
80	614389		DISPLAY PANEL METALWORK
90	BS-7.5-32	BS-7.5-32	SPACER
100	BS-10.5-32	BS-10.5-32	SPACER
110	M3-WASHER-S	M3-WASHER-S	M3 WASHER SHAKEPROOF
120	614388		DISPLAY EARTH ASSY



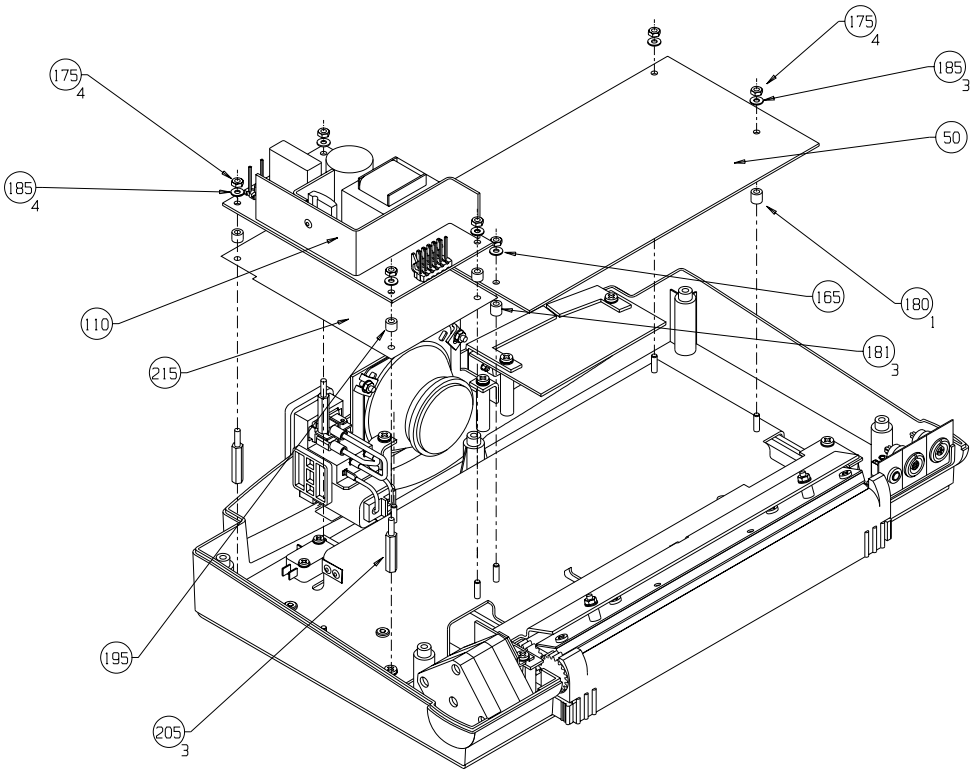
Ref.	BD4000 Part	BD4002 Part	Description
15	614390	614390	CASE BASE MOULDING
120	151321	151321	RUBBER FOOT
200	614391		BASE LABEL SET
340	CL-117-619	CL-117-619	SERIAL NUMBER LABEL



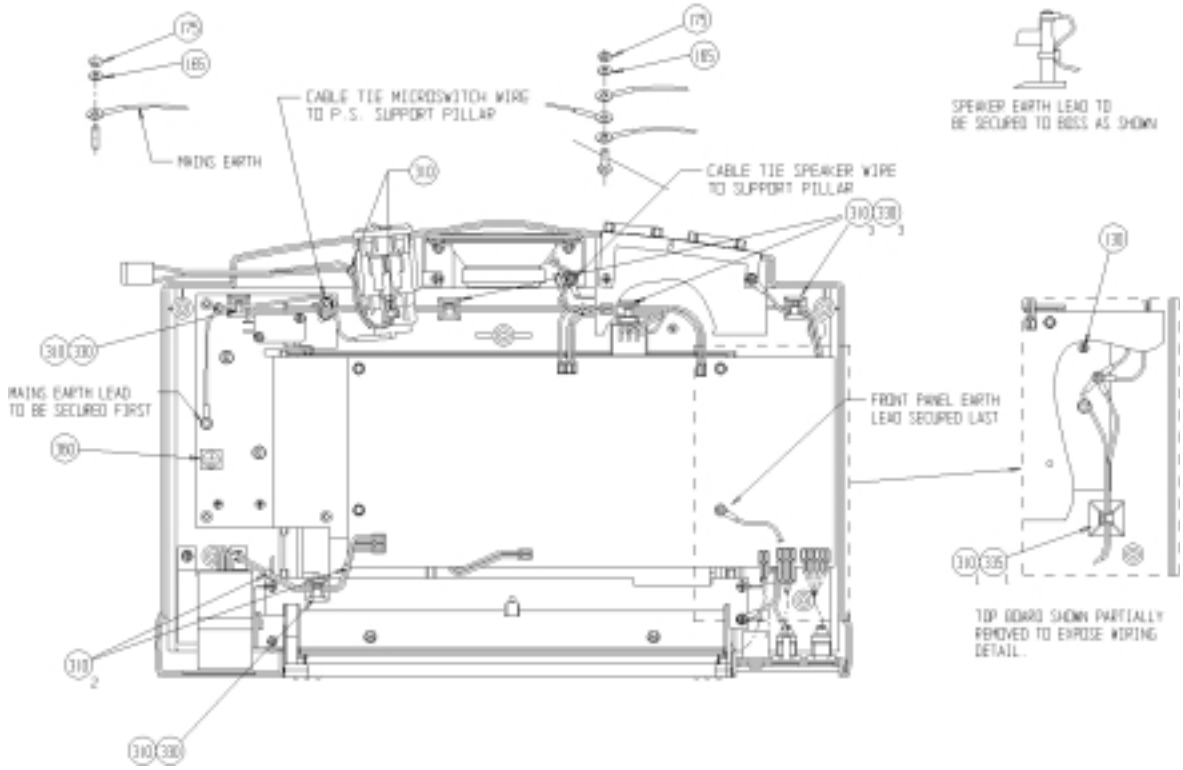
Ref.	Part Number	Description
10	614392	PAPER TRAY ASSY
15	614390	BASE MOULDING
20	614393	CHASSIS ASSEMBLY
70	614394	PRINTER MOTOR ASSY
90	614395	END OF PAPER ASSY
150	WN1412-KB30-8	SELF TAPPING SCREW
155	M3-WASHER-S	M3 WASHER SHAKEPROOF
160	M3X8-POZI-PAN	M3X8 SCREW
165	M3-WASHER-S	M3 WASHER SHAKEPROOF
350	BP190	FOAM PAD



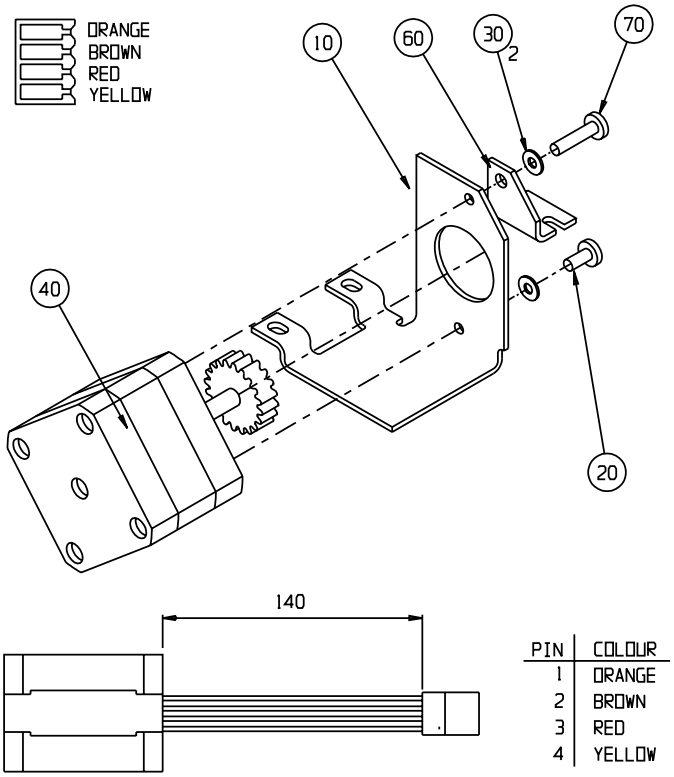
Ref.	BD4000 Part	BD4002 Part	Description
30	614396		REAR CONNECTOR PCB ASSY
40	614397		CONNECTOR PANEL ASSY
80	614419	614419	PRINT HEAD ASSY
100	614420	614420	PAPER WIDTH MICROSWITCH ASSY
105	614421	614421	SPEAKER ASSY
130	WN1412-KB30-10	WN1412-KB30-10	SELF TAPPING SCREW
160	M3X8-POZI-PAN	M3X8-POZI-PAN	M3X8 POZIPAN
165	M3-WASHER-S	M3-WASHER-S	M3 WASHER SHAKE
170	M3-WASHER	M3-WASHER	M3 WASHER
250	614422	614422	SPEAKER EARTH ASSY
280	614423	614423	MAINS SOCKET ASSY
295	614424	614424	MAIN PCB WIRE KIT
400			EARTHING FINGERS



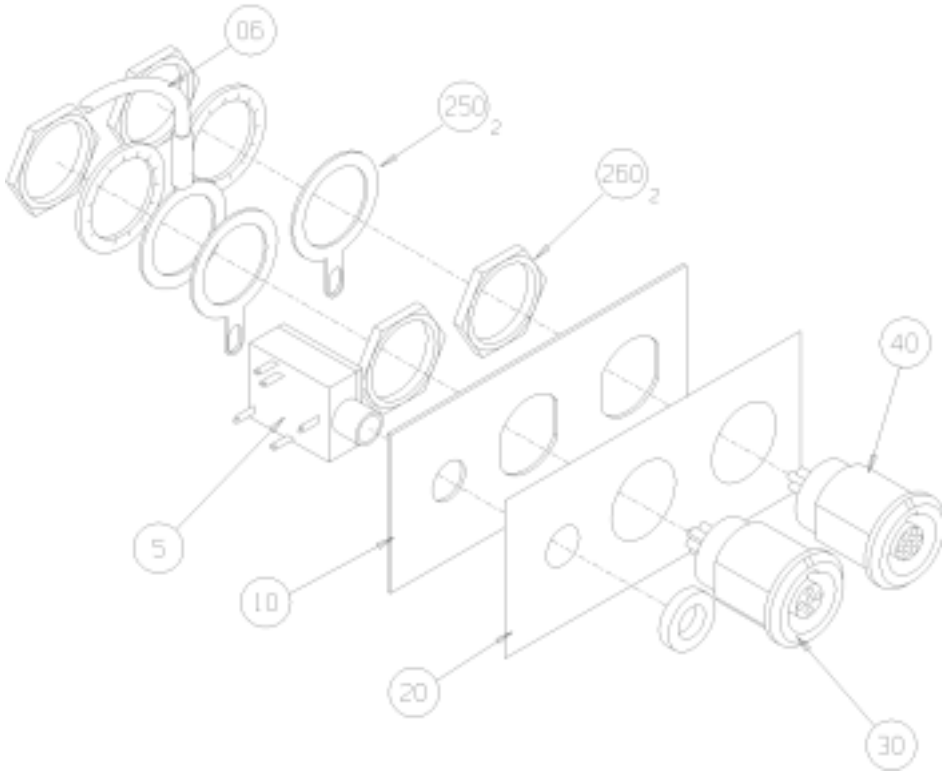
Ref.	BD4000 Part	BD4002	Description
50	614425		MAIN PCB ASSY
110	614433	614433	SWITCH MODE PSU
165	M3-WASHER-S	M3-WASHER-S	M3 WASHER SHAKEPROOF
175	M3-NYLOC	M3-NYLOC	M3 NUT
180	BS-06-32	BS-06-32	BRASS SPACER
181	NS-06-32	NS-06-32	NYLON SPACER
185	M3-WASHER-N	M3-WASHER-N	M3 WASHER
195	BS-04-32	BS-04-32	M3 BRASS SPACER
205	BP-23-B-M3X10	BP-23-B-M3X10	BRASS PILLAR
215	614426	614426	CAN INSULATOR


CABLE TIE MICROSWITCH WIRE TO P.S. SUPPORT PILLAR
MAINS EARTH
CABLE TIE SPEAKER WIRE TO SUPPORT PILLAR
SPEAKER EARTH LEAD TO BE SECURED TO BOSS AS SHOWN
MAINS EARTH LEAD TO BE SECURED FIRST
FRONT PANEL EARTH LEAD SECURED LAST
TOP BOARD SHOWN PARTIALLY REMOVED TO EXPOSE WIRING DETAIL.

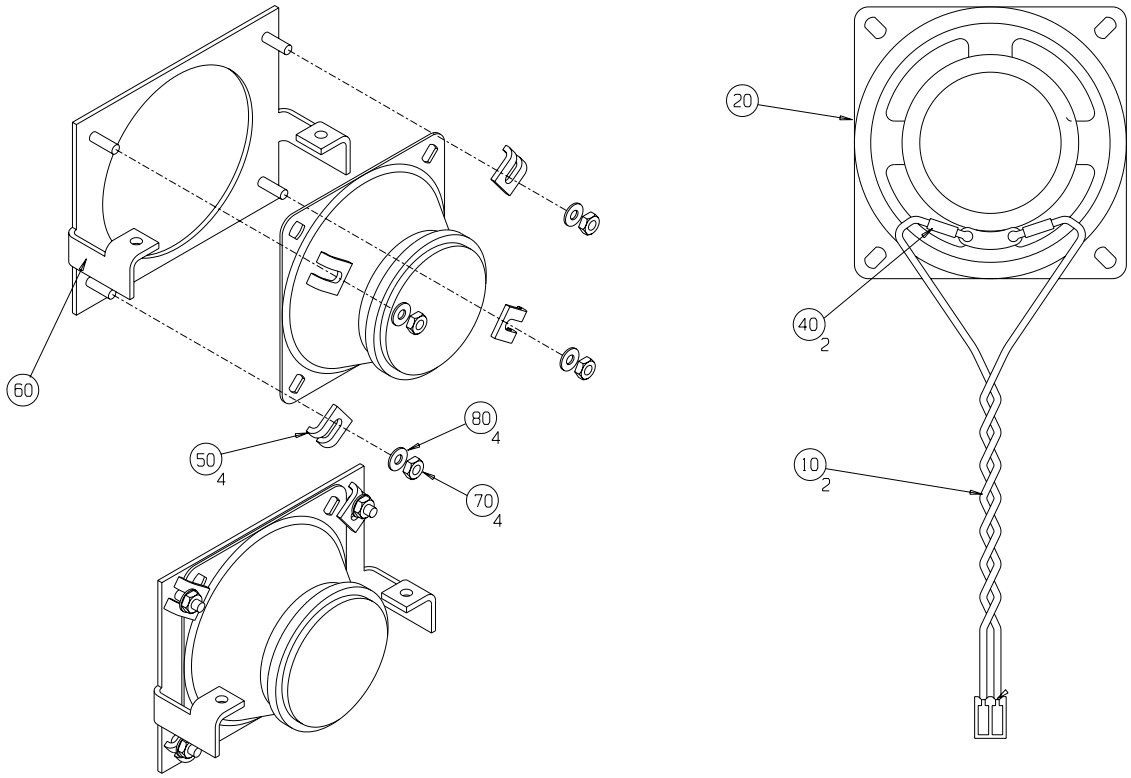
Ref.	Part Number	Description
130	WN1412-KB30-8	POZI PAN SCREW
165	M3-WASHER-S	M3 WASHER SHAKEPROOF
175	M3-NYLOC	M3 NUT
310	543-428	CABLE TIE
330	MB2A	CABLE TIE BASE 13X13
335	MB3A	CABLE TIE BASE 19X19
360	504-978	EARTH LABEL



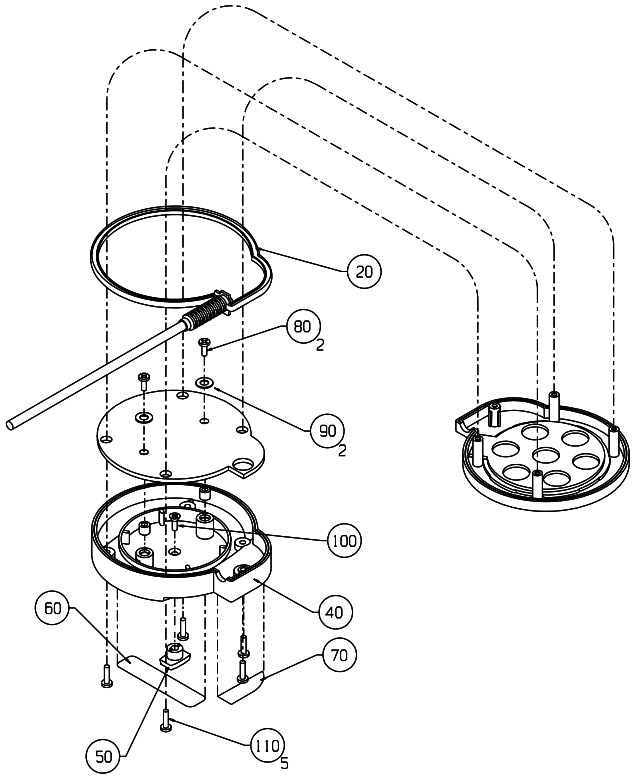
Ref.	Part Number	Description
10	614427	MOTOR MOUNTING PLATE
20	M3X6-POZI-PAN	M3 SCREW
30	M3-WASHER-S	M3 WASHER SHAKEPROOF
40	614432	STEPPER MOTOR
60	614428	MOTOR SUPPORT PLATE
70	M3X8-POZI-PAN	M3 SCREW



Ref	BD4000 Part	BD4002 Part	Description
5	FK20	FK20	EVENT MARKER SOCKET
6	614429		CONNECTOR PANEL EARTH KIT
10	614430		CONNECTOR PANEL METALWORK
20	614431		CONNECTOR PANEL LABEL
30	EGG1B305-CNL	EGG1B305-CNL	TOCO SOCKET
40	EGG1B307-CNL	EGG1B307-CNL	ULTRASOUND SOCKET
250	GCA-1S-255-LT	GCA-1S-255-LT	EARTH WASHER
260	GEA-1S-240-LN	GEA-1S-240-LN	BACK NUT

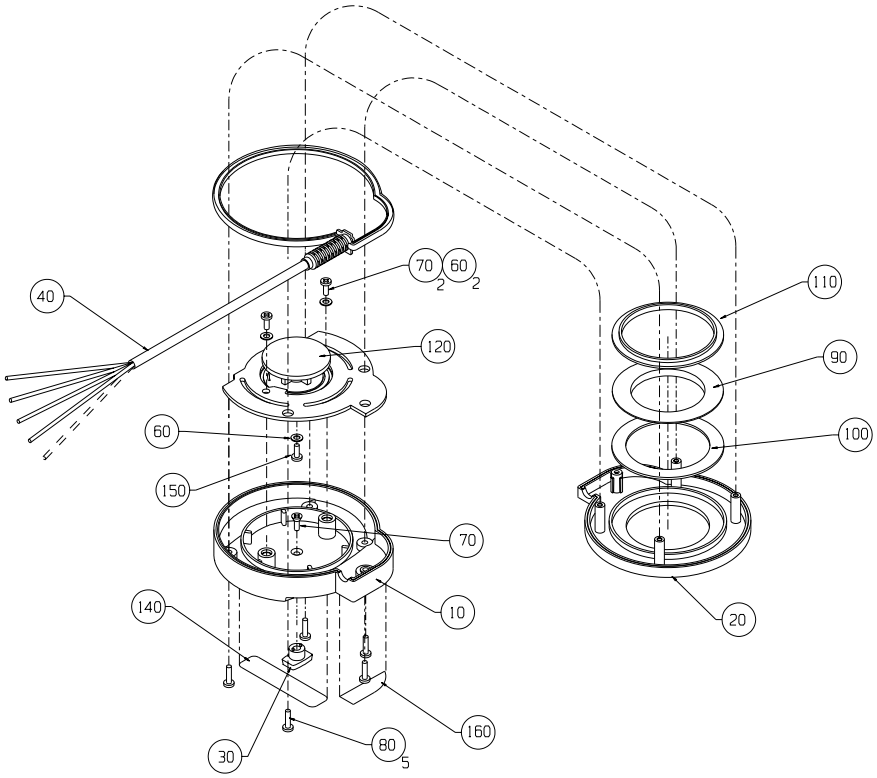


Ref	Part Number	Description
10	614398	SPEAKER WIRE - PREPARED
20	614399	SPEAKER
40	397-792	SLEEVING
50	614400	SPEAKER CLAMP PLATE
60	614401	SPEAKER MOUNT PLATE
70	M3-NYLOC	M3 NUT
80	M3-WASHER	M3 WASHER



Ref	Part Number*	Part Number**	Description
20	614404		US1 TDR CABLE ASSY
40	614402		US1 TRANSDUCER TOP
50	614408	614408	US1 BUTTON RED
60	614405	614405	US1 SERIAL NO LABEL
70	614407	614407	US1 TDR LABEL
80	M2.5X6-POZI-PAN	M2.5X6-POZI-PAN	POZIPAN SCREW
90	M2.5-WASHER-S	M2.5-WASHER	M2.5 WASHER SHAKE
100	M2.5X8-POZI-PAN	M2.5X8-POZI-PAN	POZIPAN SCREW
110	WN1412-KB22-8	WN1412-KB22-8	POZI PAN SELF TAP SCREW

* Serial numbers up to 895, ** serial numbers over 895



Ref	Part Number*	Part Number**	Description
10	614415		TOCO TDR TOP
20	614409		TOCO TDR BASE
30	614410	614410	TOCO BUTTON BLUE
40	614412		TOCO CABLE ASSY
60	M2.5-WASHER-S	M2.5-WASHER-S	M2.5 WASHER SHAKE
70	M2.5X8-POZI-PAN	M2.5X8-POZI-PAN	M2.5 POZI PAN
80	WN1412-KB22-8	WN1412-KB22-8	SELF TAP SCREW
90	1211	1211	BOOT
100	1208	1208	SEALING GASKET
110	1204	1204	TRANSDUCER SPACER
120	1210	1210	TOCO BUTTON
140	614411	614411	TOCO TDR SERIAL NO.
150	WN1412-KB22-8	WN1412-KB22-8	SELF TAP SCREW
160	614434	614434	TOCO LABEL

* Serial numbers up to 2584, ** serial numbers over 2584

13 Warranty And Service

Huntleigh Diagnostics' standard terms and conditions apply to all sales. A copy is available on request. These contain full details of warranty terms and do not limit the statutory rights of the customer.

In the unlikely event that you need to return this product, please adopt local decontamination procedures and provide documentation which outlines the product's status. Please ensure that this documentation is accessible without having to open the package.

To order spare parts and for price information, contact the Service Department at Huntleigh Diagnostics. Before phoning, be sure to have the following information available to ensure that our Service Department personnel are able to correctly identify your requirements:

Main unit model number.

Main unit serial number.

Transducer types.

Transducer serial number(s).

Part numbers of items required.

The Service Department direct line shown below offers a 24 hour service. During office hours, trained staff will be available to assist you. Outside office hours, an answering machine will allow you to leave a message.

Huntleigh Diagnostics,
Service Department,
35, Portmanmoor Road,
Cardiff, CF24 5HN, UK.

Service Department Direct Line: 029 20496793 (24 hr answer service)

Fax: 029 20492520

E-mail: service@huntleigh-diagnostics.co.uk

14 Overseas Offices

U.S.A.

Huntleigh Healthcare Inc.
227 Route 33 East
Manalapan
New Jersey 07726
U.S.A.

Tel: (732) 446-2500 or toll-free 1-800-223-1218
Fax: (732) 446-1938

Germany

Huntleigh Nesbit Evans Healthcare GmbH.,
Im Hülsenfeld 19
40721 Hilden
Germany

Tel: 0049 2103/9711-00
Fax: 0049 2103/9711-80

Australia

Huntleigh Healthcare
63 Buckingham Drive
PO Box 1116
Wangara
W.A. 6065
Australia

Tel: 00168 9309 3083
Fax: 00168 9309 4582

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As part of the ongoing development programme the company reserves the right to modify specifications and materials of the ***Baby Dopplex*** without notice.

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15 Appendices

15.1 Appendix A

A.1 Special Handling Procedures

The PCB assemblies used in the main unit, toco, FECG and ultrasound transducer contain electrostatic sensitive devices. These may be permanently damaged by electrostatic potentials encountered in routine handling of the assemblies during servicing.

We therefore recommend that all servicing be carried out in a specialised handling area (SHA) as defined by CECC00015 (published by CENELEC) to avoid damage to the assemblies.

A.2 Recommended Soldering Equipment for Rework

The following should be used for all soldering operations carried out on any Dopplex product in servicing:

Soldering Iron: 'Mini' type iron, temperature controlled to 375°C with fine tip (typically 0.8mm(1/32")) earth bonded. e.g.Weller EC3100D-ESP.

Solder: SN62 type solder with multi cored flux type RA conforming to QQ-S-571e (US federal specification). e.g. Multicore 'smart wire'.

If further information is required, please contact Huntleigh Diagnostics.

15.2 Appendix B

Torque Settings cNm	
Display Panel Metalwork to case	35
Display PCB	35
Print Head Mounting Plate	100
Print Head Support - Nuts	35
Print Head Support - Screws	35
Stepper Motor to Bracket	100
Stepper Motor Bracket to Base	100
Main PCB	25
Chassis	60
PSU	60
Speaker Bracket Screws	60
Speaker Bracket Nuts	35
Rear Panel PCB	35
Paper Tray Microswitch Plate	20
Case Lid Screws	45
Transducer Top	20
US/Toco PCB	40
Paper width microswitch	20